The Welding Engineer

NOVEMBER, 1944

THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY

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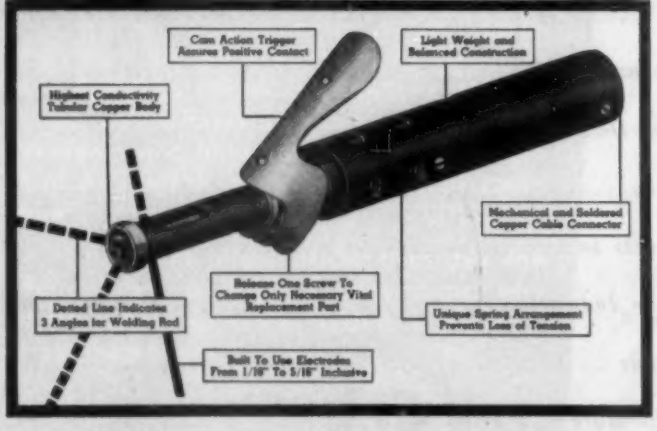
A NEW WEAPON

FOR THE MAN BEHIND THE MAN BEHIND THE GUN...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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

Shall We Stand Alone?

"Why don't we have a separate welding meeting?" was a question that seemed to pop up frequently during the recent annual meeting of the American Welding Society in Cleveland. Most of those in attendance will admit that the question was timely, especially in view of the hotel conditions (or lack of them) that resulted from an overgrown Metal Show. After the first shock of finding reservations didn't reserve, it was tough to be forced to suffer further frustration in battling bargain day shopping crowds just to see the welding exhibits, which, furthermore, were so widely scattered that a walking marathon was required to cover them.

That the welding industry and AWS have definitely been benefited by their past association with and participation in the Metal Show is a fact no one can deny. The welding industry, however, is no longer an infant nor is the American Welding Society. Both are quite capable of standing on their own feet if it has now become desirable to do so.

There are both advantages and disadvantages in standing alone, and all of them should be carefully considered before any decision is reached. The disadvantages:

(*a*) The American Welding Society will no longer be able to look to the Metal Show for financial support in connection with its annual meeting expense; (*b*) the date of the annual meeting will have to be changed from October to early spring in order to avoid conflict with other exhibitions; (*c*) the exhibitors at an exclusive welding show will not have their products exposed to anything like the mass attendance at the Metal Show. There may be other minor disadvantages, too.

The probable advantages of a separate welding meeting staged simultaneously with a welding show are:

(1) It would be an exclusive welding meeting and would be known as such instead of being just a small part of a larger gathering; (2) AWS might do better financially than it does under the present arrangements; (3) the comparatively small attendance would mean that the welding meeting could be taken to smaller cities like St. Louis, Milwaukee, Buffalo, Boston, Atlanta, Cincinnati, Birmingham, Pittsburgh, Kansas City, Minneapolis and San Francisco; (4) though the welding exhibits would be viewed by only eight to ten thousand people, each of them would undoubtedly be more interested in welding; (5) AWS members holding memberships in the other societies now participating in the Metal Show would be able to attend the annual meetings of those societies without conflicts.

Point 3 deserves a few more words. The Metal Show has grown to such a monstrous size that there are now only four cities—Chicago, Cleveland, Detroit and Atlantic City—which have facilities where it can be staged. All of these cities are "sick of conventions"—at least that is the impression one receives when trying to secure accommodations. Smaller cities might be more happy to welcome us, and undoubtedly we would receive more publicity in the local press.

Looking at the matter judicially, it would seem that a separate annual meeting and exhibit would contribute to welding progress; on the other hand there are the disadvantages previously pointed out and possibly others. What are your opinions on this subject?

Shall we or shall we not stand alone? That is a question that the welding public will have to decide before AWS officials can act. Please let us have *your* comments so that we can pass them along to the interested parties.

THE POSTWAR WORLD is going to see the production of many new, high-strength alloy steels. This means new arc welding electrodes to meet the new metallurgical requirements.

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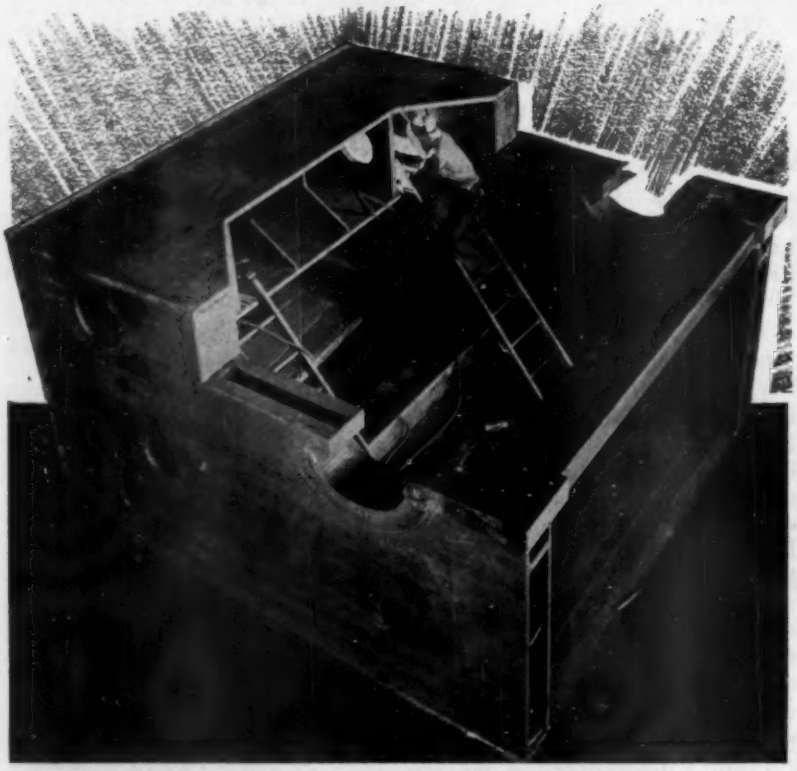

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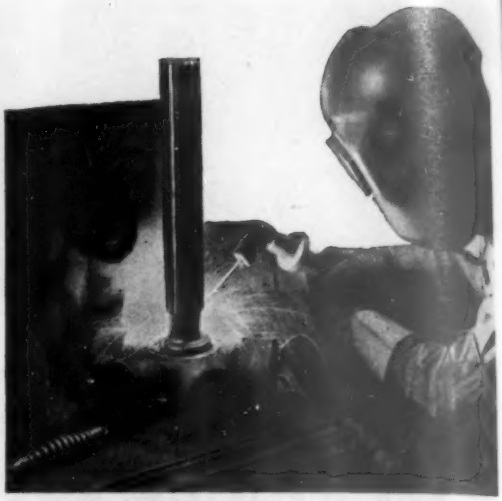

THIS COUPLING SHAFT, used by Caterpillar Tractor Co. in a running-in stand for testing Diesel engines, is subject to extreme tension and torsional stresses. In case of breakage, it is repaired with Murex Electrodes because of the high tensile strength and excellent physical properties of the weld metal.

CRAWLER FRAMES of high speed tractors are welded with Murex Genex Electrodes by International Harvester Company. Positioning enables the frames to be tilted to the most advantageous angle for each operation.

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AWS Convention

There weren't enough cigarettes or hotel rooms, but there was a plentitude of welding information to be found. Nearly 1,800 visitors registered for the 25th annual meeting of the American Welding Society.

THE 25th American Welding Society meeting the week of October 16 to 20 found Cleveland short of hotel rooms and cigarettes but long in welding knowledge. Despite the confusion caused by a definite shortage of hotel accommodations, the meeting at the Cleveland Hotel proved to be one of the most successful ever held by the Society. A total registration of nearly 1,800 welding engineers, supervisors and other individuals earnestly seeking knowledge on welding brought attendance to a near-record peak.

Welding's Contribution

The opening session began with a brief address of welcome by Retiring President David Arnott, following which the American Welding Society was presented the Ordnance Distinguished Service Award. The award of this honor was announced last July, but its formal presentation was delayed until the Society's annual meeting. In his presentation speech, Colonel S. B. Ritchie, assistant chief, research and development, office of Chief of Ordnance, discussed the preeminent importance of research and development for national defense. Colonel Ritchie credited the American Welding Society and Welding Research Council with playing a vitally important role in putting the best weapons to be provided—in sufficient quantity and on time—into the hands of our troops. He discussed various instances of coöperation, including the preparation of the Ordnance inspection handbook for metal-arc welding by the AWS, WRC and Ordnance Department. "As a result of this knowledge," Colonel Ritchie stated, "we have been able to use welding in production work to a far greater degree than our enemy."

In a subsequent paper Rear Admiral H. L. Vickery declared: "I think it can be said without reservation that the American Welding Society, more than any other technical society, has been responsible for the promoting and improving of welding so far as the Maritime Commission is concerned.

"The committees of the Society have developed a common language of welding symbols, proposed controlling techniques, qualifications and test procedures and standards. All of these are generally accepted by various code authorities and have been incorporated into the rules for Government maritime welding today."

Awards and Prizes

The opening session also included the annual presentation of medals and prizes. The 1943 Samuel Wylie Miller Memorial Award (medal and certificate) was presented to F. T. Llewellyn for "contributions to the structural welding field." Mr. Llewellyn, now retired, was formerly director of research for the United States Steel Corp.

The Lincoln gold medal, donated by James F. Lincoln, president of The Lincoln Electric Co., was awarded jointly to Dr. Wendell F. Hess, assistant professor of metallurgical engineering, Rensselaer Polytechnic Institute, Troy, N. Y., and Lt. D. C. Herrschaft, AAF. The award is presented each year for the paper judged to be the greatest contribution to the advance and use of welding. This

A. C. WEIGEL

New AWS president. Mr. Weigel is with Combustion Engineering Co., Inc.

ISAAC HARTER

AWS first vice-president Harter is vice-president of Babcock and Wilcox.

W. F. HESS

Dr. Hess, Rensselaer Polytechnic Institute, was elected second vice-president of AWS.

LT. D. C. HERRSCHAFT

REGINALD B. BLAND

PAUL E. SANDORFF

Resistance-welding prize winners. Lieutenant Herrschaft co-authored a paper with Dr. Hess which won the RWMA University Prize of $100. Messrs. Bland and Sandorff won the $100 Industrial Group prize for their paper on "The Dynamic Properties of Flash-Welded Tubing."

year's award was made on the co-authored paper, "Spot Welding of SAE 1020, 1035 and 1045 Steels in the 0.040 In. Thickness," which had been presented at the Society's 24th annual meeting last year.

The same paper which won the Lincoln gold medal also won for Dr. Hess and Lt. Herrschaft the University Prize of $100, awarded by the Resistance Welding Manufacturers Association. Dr. Hess, R. A. Wyant, O. E. Stabler and F. J. Winson received honorable mention in this award for their paper entitled "A Study of the Application of Refrigeration to the Cooling of Spot-Welding Electrodes."

The Industrial Group prize of $100, another of the RWMA awards, was given for the paper entitled "The Dynamic Properties of Flash-Welded Tubing" by Reginald B. Bland and Paul E. Sandorff, both senior research engineers with Lockheed Aircraft Corp., Burbank, Calif. Honorable mentions were: L. C. Bibber and J. Heuschkel for their paper "The Spot Weldability of Low Carbon and Other Aircraft Steels"; B. Cooper for his paper "Better Welds through Regulated Welding Current"; S. Wong and C. W. Steward for their paper "Spot-Welding Joint Efficiency"; J. C. Barrett for his paper "Properties of Heat-Treated Flash Welds in a Chromium Nickel-Molybdenum Steel."

Second Adams Lecture

The Monday evening session was devoted to the Adams Lecture, the second of these lectureships established by the Society's board of directors in honor of its first president—Comfort A. Adams. Each lecture is to cover some phase of the science of welding and is to be given by an outstanding authority within his field, who will be selected by the committee of awards with the approval of the board of directors. In keeping with this tradition, the second lecture was given by Dr. A. B. Kinzel, vice-president, Electro Metallurgical Co., and chief metallurgist, Union Carbide and Carbon Research Laboratories. It was entitled "Solid-Phase Welding."

Dr. Kinzel used the term "solid-phase welding" to designate that method of joining two structural members in which none of the material is melted at any time during the welding process. (A recently developed practical application is oxy-acetylene pressure welding.) Dr. Kinzel defines solid-phase welding as a process by which "structural members are bonded by atomic forces without the presence of a liquid phase at any stage." The process comprises the pressing together of clean, smooth surfaces so as to substantially exclude air and the maintenance of suitable pressures while heating is done to effect bonding. Temperature was shown to be the dominant factor in solid-phase welding. A temperature of 1,050 C (1,922 F) appears to be the feasible minimum and 1,200 C (2,192 F) the maximum.

Successful experiments with the welding of austenitic steels and brasses were reported. Numerous tests lead to the conclusion that complete interface elimination as determined by the microscope is the best scientific criterion of the quality of a pressure weld, although desirable physical properties such as yield strength, tensile strength, elongation and reduction in area are necessary to engineering purposes.

On recommendation of the award committee, Dr. S. L. Hoyt, Battelle Memorial Institute, was unanimously approved by the board of directors as the 1945 Adams lecturer.

Some 57 varieties of papers—not pickles—were presented during the week to cover all phases of welding. The more important ones are abstracted in this issue, beginning on page 58.

The meeting closed Thursday afternoon with the business meeting. It was indeed gratifying to learn that the Society's membership has now increased to 7,809, distributed among the 51 local sections.

Among the important announcements was the establishment of two new technical committees. A coördinating committee on research was appointed to effect closer collaboration between American Welding Society standardization activities and the research activities of WRC. A committee on metallizing was appointed to prepare standards for various applications of the metallizing process.

New Officers

The meeting was brought to an end by the installation of new officers and the award of the retiring president's emblem to David Arnott. A. C. Weigel, vice-president, Combustion Engineering Co., Inc., is the Society's new president. Isaac Harter, vice-president, Babcock and Wilcox, Barberton, O., is first vice-president. Dr. W. F. Hess, associate professor of metallurgical engineering, Rensselaer Polytechnic Institute, Troy, N. Y., is second vice-president, and O. B. J. Frazier, director of technical service on mill products, International Nickel Co., Inc., New York City, was re-elected treasurer.

Directors at large are: R. W. Clark, welding engineer, General Electric Co., Schenectady, N. Y.; L. W. Delhi, manager, Western Pipe & Steel Co., San Francisco; J. F. Lincoln, president, The Lincoln Electric Co., Cleveland, and H. M. Priest, engineer, railroad research bureau, U. S. Steel Corp., Pittsburgh.

Seven district vice-presidents were also elected. They are: F. C. Fyke (New York and New England), materials engineer, general engineering dept., Standard Oil Development Co., Elizabeth, N. J.; H. W. Lawson (mid-eastern) engineer, Bethlehem Steel Co., Bethlehem, Pa.; F. E. McAtee (southern) assistant superintendent, Chicago Bridge & Iron Co., Birmingham, Ala.; J. F. Maine (central), chief engineer, Republic Structural Iron Works Co., Cleveland; W. J. Brooking (mid-western), director testing and research dept., R. G. LeTourneau, Inc., Peoria, Ill.; M. A. Barrett, (mid-southern), shop engineer, Beech Aircraft Corp., Wichita, Kan.; and F. A. Longo (western), general boiler inspector, Southern Pacific R. R. Co., San Francisco.

ELLSWORTH L. MILLS

Retiring president Ellsworth L. Mills, The Bastian-Blessing Co., Chicago, tried facetiously to prove with a 12 inch cigarette holder and a Harvard accent that he was the International Acetylene Association's "indispensable man." Nevertheless, the nominating committee refused to be persuaded to a third term for Mr. Mills, and the members elected Glenn O. Carter, of The Linde Air Products Co., the new IAA president.

GLENN O. CARTER

44th Annual IAA Meeting

Both facts and fun were featured at the business meeting and lunch of the International Acetylene Association at the Hotel Statler. The past year's work in safety codes was reviewed.

THE International Acetylene Association held its 44th annual business meeting at the Statler Hotel, Cleveland, on October 18th. The meeting started with a noon luncheon and lasted only until 2 o'clock.

The "Indispensable" Man

In a brief address, President Ellsworth L. Mills "severely" raked over the coals the nominating committee for failing to provide him with a 3rd term. Aided by a 12 inch cigarette holder, President Mills tried to prove in his best "Harvard accent" that he was an indispensable man. As he stated, "Hasn't the acetylene industry had its greatest growth during *my* term of office? Hasn't the industry sold more carbide during *my* term of office than in any other period of history? Hasn't there been more welding apparatus sold during *my* term than ever before? Who other than *I* am responsible for this?" His pleas, however, fell on the deaf ears of the nominating committee.

In a more serious vein, Mr. Mills pointed out that we must not be afraid to keep the people alertly conscious of what the members of the association have contributed to the common good. The acetylene industry has advanced because it has been continually alert to new ideas.

Mr. Mills' opening address was followed by a talk by Paul Bellamy, editor of the Cleveland *Plain Dealer*. Speaking on "Some Pertinent Aspects of Current Events," Mr. Bellamy deplored softness on the domestic front just as much as he deplored it in international affairs and warned that a nation which becomes soft is destined to failure. Germany must be occupied, he said.

Prepare Army Manual

H. F. Reinhard, giving the annual secretary's report, outlined IAA activities during the past year. He placed particular emphasis upon coöperative efforts with other societies, pointing out as a specific example that during the summer the association coöperated with representatives of the headquarters of the Army Engineer School at Fort Belvoir, Va., to prepare a pamphlet to guide Army troops in the safe handling of compressed gases. Copies of this pamphlet will be made available to IAA members as soon as they are printed. He also reviewed other activities of the association, including the James Turner Morehead Medal Award dinner held last January.

J. I. Banash, consulting engineer for IAA, stressed the work the association had been doing in assisting in the production of safety codes. Two of these have been completed under the auspices of the American Standards Association and are now in print; namely, "Safety Code for Building Construction No. A10," in which gas welding and cutting have a prominent part, and "Safety in Electric and Gas Welding and Cutting Operations." The latter publication was the subject of a very intensive study and covers the field thoroughly.

Other reports followed, including those of the treasurer, auditing committee, oxy-acetylene committee and the nominating committee.

New Officers and Directors

Glenn O. Carter, The Linde Air Products Co., New York City, was elected president; R. B. Swope, Southern Oxygen Co., Inc., vice-president; H. F. Reinhard, Union Carbon and Carbide Corp., secretary; Philip Kearny, K. G. Welding and Cutting Co., treasurer.

Five new directors were also elected at this meeting. E. L. Mills, The Bastian-Blessing Co., Chicago; H. P. Dolisie, Canadian Liquid Air Co., Ltd., Montreal and C. D'W Gibson, Air Reduction Sales Co., New York City, were elected for three years. C. M. Pitts, People's Gas Supply Co., Ltd., Ottawa, Ontario, was elected for one year to fill the unexpired term of R. B. Swope. P. E. Engler, Balback Co., Omaha, was elected for two years to fill the unexpired term of W. C. Keeley.

Welding Labor

By **THEODORE W. KHEEL**
Executive Director, War Labor Board

Beneath this large American flag flying over the yards of California Shipbuilding Corp., are 38,000 men and women whose business is the production of ships for victory. This yard is only one of many shipyards: all of them at present employ about 1,500,000 persons, of whom over 8% are welding operators.

Acme Photo

THE ingenuity of American business and labor has amazed the entire world. Our production of 150,000 planes—28,000 of which went to our allies—and the expansion of our shipbuilding industries has surprised even our own production engineers. But the war is not over yet, and we cannot afford to be complacent as long as we need still more weapons that must be fabricated.

Importance of Welding

Welding has largely replaced riveting in the fabrication of planes, tanks, barges, ships and many other vital war materials. Moreover, women can weld, and as the shortage of manpower became acute, women weldors have appeared all along the production line.

Welding has played an important part in the phenomenal growth of the shipbuilding industry. In 1942 there were only 146,300 persons employed in shipyards, (exclusive of the Navy Yards); at the present time there are about 1,500,000 employed. Of these over 8% are weldors.

Perhaps the reader will forgive a pun when we say that without the welding of labor and management we would have bogged down completely. There has been comparatively little difficulty in the shipbuilding industry, for instance. One of the reasons for this is the fact that the Shipbuilding Stabilization Committee, comprised of labor, management and the procurement agencies of Government, stabilized wages for that industry on a zone basis on June 23, 1941.

Essential to Victory

The nation early recognized that smooth industrial relations were essential to maximum production and victory. A few weeks after Pearl Harbor, labor and management leaders assembled at the White House and made the no-strike, no-lockout pledge. However, it became apparent that under the stresses of wartime conditions Government supervision of certain labor problems would be necessary if our production was to reach the goals necessary to overhaul enemy production.

To handle such problems, the President on January 12, 1942, established the National War Labor Board. This twelve man board, with an equal representation for labor, industry and the public, was appointed by the President, with William H. Davis, one of the four public members, as chairman.

Wage Stabilization Measures

The board devoted itself to handling labor disputes until October, 1942, when Congress passed the Economic Stabilization Act. Executive Order 9250 designated the War Labor Board as the agency to stabilize wages and salaries at the levels of September 15, 1942. Wage increases granted by the board since that time have been approved for the following reasons:

1. *The Little Steel Formula* permits general wage increases "across the board" up to an amount which is equal to 15% of the average straight-time hourly rates that prevailed January 1, 1941.

2. *Substandards of Living.* Regional boards have been authorized to approve voluntary applications by employers to increase minimum hourly wage rates up to 50c. A few boards have established rates for certain areas below 50c. In dispute cases involving rates below 50c, regional boards may consider appropriate prevailing rates in the area.

3. *Increases to correct plant inequities* in rates paid for similar work in comparable plants may be approved to bring the existing rate up to the minimum of the sound and tested prevailing rates for that job in the industry and area.

4. *In rare and unusual cases* to meet the critical needs of war production, the board may grant increases above the minimum of sound and tested rates. However, such increases are rarely granted and a showing must be made by the War Manpower Commission, the War Production Board, Army or Navy that the increase in wages is essential in order to obtain the necessary manpower for war production.

5. *Intra-plant inequities.* Increases to correct these may be approved subject to the limitation that such adjustments must not increase the level of production costs appreciably or furnish the basis either to increase prices or to resist otherwise justifiable reductions.

Sample Decisions

Several board decisions will illustrate some of the permissible types of increases in the aircraft and shipbuilding industries where the decisions affected weldors among other employees.

Illustrating the "Little Steel" formula, a decision of March 3, 1943, granted increases to some of the employees of the Boeing Aircraft Co. who had not received the full 15% since January, 1941. White-collar employees of that company also received wage or salary adjustments through establishment of a job classification schedule.

The War Labor Board in July, 1943, unanimously awarded increases ranging from 5c to 40c an hour to

approximately 400 workers at the Daytona Beach Boat Works, Daytona, Fla. The approved schedule of rates ranged from a 55c starting rate for trainees to a $1.65 top rate for foremen. The previous range was from 40c to $1.25. The opinion of the board reads in part: "The decision causes the rates in this yard more nearly to approach the sound and tested going rates in the industry."

To illustrate wage inequities within plants, we cite the decision on the Boeing Aircraft Co. on March 3, 1943, when the board found that the pay schedules of the plant were not uniform.

The board approved a wage classification schedule which related wage rates to the skill required for the job.

Incentive Plans

Firms with established incentive plans may continue them. If a plant changes the machinery or the methods of production and desires to adjust the incentive plan, this may be done without reference to the board. However, if changes are made in the wage structure, it will be necessary to obtain the War Labor Board approval for these changes. The board feels that management should not resort to incentive plans until faulty production methods have been eliminated and the fullest utilization of the available manpower made.

Discretion is exercised by the board in determining the acceptability of incentive plans. However, it is interesting to note that as of March 15, 1944, the regional and national board have acted upon 1,431 incentive plans with only 352 denials. This is partly due to the fact that the board does not consider increased pay for increased production as a wage increase under the wage stabilization program.

Nevertheless, it is, the responsibility of the employer to show that his incentive proposal conforms to the stabilization policy and is not a method by which hidden general increases in pay are planned.

The board has also approved the reduction of certain wage rates set up within an incentive plan when it was found to be set so loosely that unskilled labor earned hourly wages which were far higher than the sound and tested rates in the area. In one company where an incentive plan had been set up, it was found that some of the common laborers earned more than the skilled workers.

Overtime, Vacations

In cases where a firm does not grant premium pay for hours worked over 40 hours, the board may approve the request for such payment.

When bonus pay for the swing or graveyard shift is the common practice in a certain industry and area, an application to put this into effect in a plant may be made with the board. Vacations, too, may be approved if they match the customary schedule in the industry. The board generally approves one week's paid vacation after a full year's employment and two weeks' vacation after five years of service. Work or safety clothing furnished by the employer, reasonable sick leave plans and various other such adjustments may be approved.

Courtesy, OWI

As the manpower shortage became acute, women welders appeared all along the production line.

Increases *not* Requiring Approval

Individual increases for merit and length of service within established rate ranges may be given without board approval. If the employer does not have established rate ranges for his various job classifications, he may secure approval thereof by application to the board. The individual increases within the rate ranges cannot exceed 10c per straight-time hour or 2/3 of the range for any one employee during the year, and the total amount expended cannot exceed an average of 5c per straight-time hour for all employees in the establishment whose rates are under WLB jurisdiction.

Firms with 30 or fewer employees, even without such a schedule, may give individual raises without board approval. However, the "5 and 10" limitation prevails here also, so that increases to individuals must be limited to 10c an hour per year and the average increase must not exceed 5c an hour.

The new rate must not exceed the highest rate paid for that job classification between July 1, 1942, and July 1, 1943. In addition, the increases must not be a basis for increasing the prices of the product manufactured and must not be contrary to any collective bargaining agreement.

Approval is not necessary for increases incident to promotion to a job requiring greater skill and greater responsibility.

Not under WLB Jurisdiction

Pay increases not under the jurisdiction of the War Labor Board include:

1. Increases to employees receiving more than $5,000 a year or in supervisory capacities who are not represented by a union. These require Treasury Department approval.
2. Increases in an establishment employing eight or fewer workers, except in certain specified industries, unless the employees are covered by a master bargaining agreement.
3. Increases to equalize rates paid women performing the same work as male employees at the same plant.
4. Increases to meet requirements of the Walsh-Healy Public Contracts Act when a firm has a Government contract and to comply with state minimum laws up to 50c an hour.

When labor and management wanted to attain what was once an almost unbelieveable production goal (now growing ever greater), the recognition that good industrial relations are vital helped us reach these production peaks. The board believes that a grievance procedure ending in arbitration should be set up in each collective bargaining agreement.

Since the Wage Stabilization program started on October 3, 1942, the War Labor Board has made decisions on more than 273,000 voluntary wage cases. Over 11,000 labor dispute cases were decided, involving more than 12,000,000 workers.

The tripartite structure of the National War Labor Board should have future influence on the smoothness of industrial relations. Labor and industry members of the different boards, commissions and panels have learned much from each other's viewpoints and problems. Their own views have broadened vastly, and they have acquired a new trust in each other.

Fig. 1—In service, pressure-welded rail provides a smooth running surface without the flexions (folds) due to joints. This means quiet comfort for passengers, less wear and tear on equipment and freight, the elimination of joint maintenance.

Welded Railroad Rails

★ Part One—The continuous rail offers a big market for welding in the postwar world. This new series of articles will discuss each of the three chief welding methods—oxy-acetylene pressure, flash and thermit.

By CLYDE B. CLASON

THE familiar clackety-clack of the car wheels is a sound that is almost certain to be eliminated from the railroads of the future. Gapped joints between rails will have to go when increased train speeds demand continuously even rail surfaces to provide shockproof transportation of both freight and passengers. Already the trend to all-welded continuous rail is being manifested. A gapless section as long as 12,753 ft is now in service (Elgin, Joliet & Eastern).

Reduced Track Maintenance

Besides giving smoother riding, continuous welded rail reduces track maintenance by eliminating the need for shimming or replacing joint bar, or bolt replacement, bond replacement, building up of rail ends by welding, etc. The cost of maintenance has been lowered by as much as 25%, one railroad estimates. Welded rail is not subjected to the end batter and fishing wear which shorten the life of bolted rail. Ties will last much longer; cars and locomotives will be spared much of the effects of vibration. Line and gauge are also easier to maintain with continuous rail, and the appearance of the track is greatly improved (Fig. 1).

On the debit side are the initial expense, the difficulty of hauling and laying long strings of rails, the difficulty of replacing worn or damaged rail sections. The last might be a serious objection were renewals needed as often as for bolted rail, but the great extension of rail life made possible by the elimination of batter more than counterbalances the difficulty of replacement.

Sun Kinks Not a Problem

Doubtless every reader of this article learned in high school physics that railroad rails are laid with a slight gap between them in order that the expansion caused by increases in temperature may not buckle the rail and perhaps tear it loose from the ties. Bearing in mind the 39 ft length of the individual rail, it seems almost impossible that welded sections as long as 12,000 ft can be laid without any compensation whatsoever for expansion and contraction. Neverthe-

less, this surprising fact is quite true.

This is not because the expansion and contraction effects are imaginary. They are very real quantities. If unrestrained, a rail one mile long will expand approximately 41 in. per 100 degree rise in temperature. Since temperature extremes of minus 30 F and 120 F—a 150 degree range—are known on some railroads, the one-mile rail length could increase in length by more than 60 in., provided that it *were free to move*.

The answer to the apparent paradox lies in the four italicized words at the end of the last paragraph. A rail not free to move simply cannot expand nor contract as the temperature rises and falls. Instead of movment there will be internal stress, and the problem becomes solely a question of determining the amount of strain and making an adequate allowance for it.

19,500 Psi per 100 F

It was found by the Committee on Track of the AREA (Proceedings, Vol.38, p.493) that a restraint of sufficient magnitude to prevent expansion and contraction from manifesting themselves as movement will set up an internal stress in the rail of 195 psi for each change of 1 F in the temperature. Multiplying, we quickly discover that this means a total stress of 19,500 psi for a 100 degree temperature change. This maximum internal stress, however, will not occur unless the rail has been laid at the lowest or highest end of its temperature range; *i. e.* at either zero or 100 F, assuming for the sake of simplicity that the temperature will not vary beyond these limits. Ordinarily, though, the rail would be laid at a temperature midway between the two extremes; say between 50 and 60 F. The rail when laid will have no internal stresses since it has been free to expand or contract up to this point. The range of temperature variations capable of creating stresses will be reduced, therefore, by about one half (from 50-100 F instead of from 0-100 F), and the maximum internal stress will be accordingly reduced from 19,500 to 9,750 psi.

Since railroad rails are designed for a tensile strength on the order of 133,000 psi, it is readily seen that the strain of expansion and contraction can be ignored if the rails are securely anchored.

History and Applications

The continuous welded rail is a mere baby of 14 years. It was first introduced in 1930 by the Central of Georgia for the track in two tunnels, and its first use in open track occurred in 1932. Today there are open-track installations of from ½ to 42 miles long on many railroads—Bessemer & Lake Erie; Central of Georgia; Delaware & Hudson; Southern; New York, New Haven & Hartford; Illinois Central; Missouri Pacific; Chicago Great Western; Duluth, Missabe and Iron Range; Norfolk and Western; Great Northern; Boston and Maine; Elgin, Joliet & Eastern; Chicago and Illinois Midland; Northern Pacific; Denver and Rio Grande Western; Erie. Rails ranging from 100 to 131 lb are included in these installations.

Though continuous welded open-track installations have not been in general use long enough for much to be said concerning their performance and service life (five years is believed to be the minimum service period upon which authoritative conclusions can be based), it is safe to say that the present installations have so far proved successful, and particularly so on heavy-traffic lines. On some lines as many as 60 trains pass over the welded rail sections during every 24 hr.

At present, however, open-track installations are probably of less importance than special applications. In tunnels, continuous welded rail eliminates the joint bars, bonds and other connections that so often serve as focuses for corrosion. The extension to subway track is obvious. On bridges, it eliminates noise and vibration and reduces impact by from 15 to 50%, according to the estimates of bridge engineers. At road crossings, welded rail materially reduces the usual excessive maintenance needed and helps greatly to prevent the customary early breakdown of the pavement. Similar advantages are obtained from its use at station platforms and on track running through city streets. Another important application is for turnouts; it is recommended that at least the lead rail be welded on such sidetracks.

Pressure Welding

Of the three methods used for joining railroad rails into continuous lengths, only the oxy-acetylene pressure welding method will be discussed in this article. The other methods—thermit welding and flash welding—will be reserved for consideration in subsequent issues of THE WELDING ENGINEER.

The oxy-acetylene pressure process was first introduced to the railroad

Fig. 2—Overall view of a typical oxy-acetylene pressure rail welding set-up. In the foreground the prepared rails are stacked for positioning in the welding machine (A). After welding, they are taken to the cutting station (B), to the normalizing station (C) and finally to the grinding and polishing station (D). At the extreme left of the picture, the power winch (E) pulls the rails to these various points on the production line.

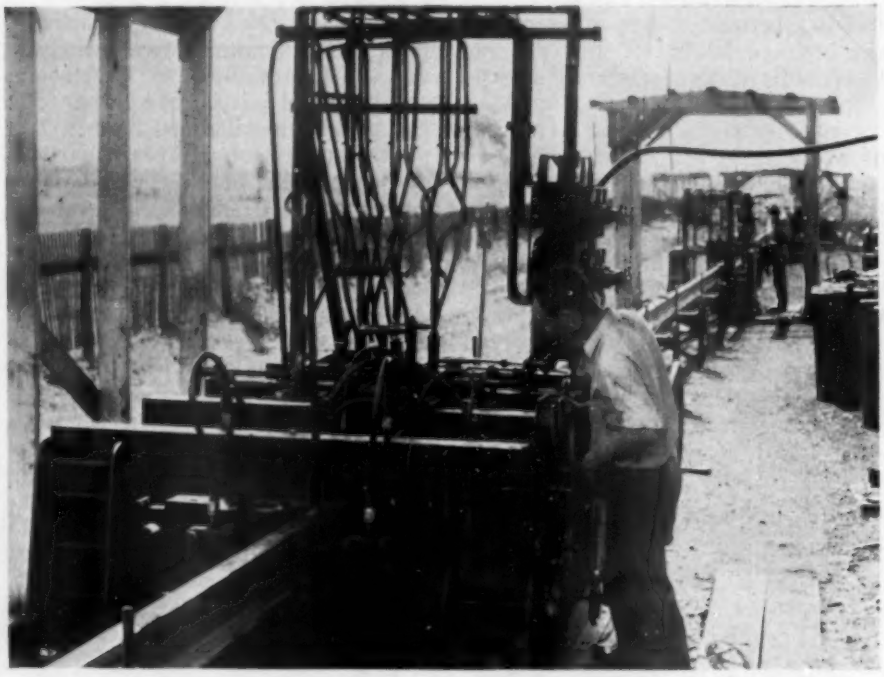


Fig. 3—The welding machine. Through the combination of heat and pressure, strong, dependable welds are made.

field in 1938. Its advantages are its comparatively low cost and simple equipment, the elimination of the human element and the consistently high quality of welds produced.

This welding procedure was developed and perfected by The Oxweld Railroad Service Company, a subsidiary of Union Carbide and Carbon Corporation. It is a heat-and-pressure process in which the bond is formed at a temperature below the melting point of the materials being joined. Metallurgically speaking, the bond is formed by diffusion and recrystallization while the metal is in its solid (though plastic) state.

The process involves the steps of: (1) facing the rail ends, (2) heating them to welding temperature (about 2,280 F), (3) forcing them together under a pressure of around 2,500 psi., (4) flame-cutting the upset metal, (5) normalizing the heat-affected area for grain refinement and (6) grinding the weld to a smooth finish.

Production-Line Set-up

These several operations are performed in a continuous production line at stations a rail length (39 ft) apart. (Steps 2 and 3 are naturally performed at the same time on one machine.) As soon as one step has been completed, a power winch pulls the rail to the next station.

An overall view of a typical field set-up is shown in Fig. 2. In the foreground are the prepared rails stacked ready for positioning in the pressure-welding machine (A). The welded rail then goes to the cutting station (B), to the normalizing station (C) and finally to the grinding and polishing station (D). Performance of the five operations calls for a crew of about 12 men, whose output will average some 20 to 30 completed welds per day. As many as 61 welds have been made in a 10 hr day with one machine.

Heart of all the equipment is the welding machine (Fig. 3), a unit mounted in a heavy frame of structural members. Gripper blocks at front and rear seize the sides of each rail. Midway between the two sets of gripper blocks is the welding head, which consists of four blocks of oxy-acetylene tips to direct flames from above, from below and from both sides at the rail ends being joined. The tips are so arranged that large flames are applied to the ball and to the center of the base, lesser heat to the web and the flanges of the base. Thus both thick and thin sections of the rail are brought to welding temperature at the same time.

Longitudinal pressure is applied through the rear grippers by means of two hydraulic cylinders, one on each side of the rail. A 5 hp, 2 cylinder gasoline engine drives the two-stage, vane-type pump supplying oil to the hydraulic cylinders and also operates a small pump for the circulation of cooling water through the tip blocks.

Groups of oxygen and acetylene cylinders are manifolded together to supply the welding gases. The necessary valves and gauges, including a quick-action shut-off valve for each tip block, are mounted on a single control panel.

Preweld Preparation

To make a sound, straight weld, the abutting rail ends must be square and fit so tightly together that there can be no air space between them. There are two ways of obtaining such a fit in general use: rails can either be ordered from the steel mill with specially milled ends, or rail received from the mill can be end-finished with special heavy-duty power saws that take a cut on two adjoining rail ends at one time and thus provide perfectly matched faces. All rail must be furnished without bolt holes; if second-hand rail is to be welded, the ends are cropped off beyond the bolt holes and the short ends are scrapped.

Whether mill-finished or field-finished, the prepared rail ends are usually protected from rust by a grease coating, and this must be removed with a suitable solvent by the welding machine operator. The cleaning is done immediately prior to welding.

Fig. 4—Close-up of weld as it comes from the welding machine. The ridge is formed of metal upset by the pressure applied to the plastic rail ends.

Welding the Rails

The two rails fed into the welding machine are gripped and held by hydraulically operated clamps which have been shaped to the contours of the rail cross-section. Passage of the rails through the machine is facilitated by a heavy roller at each end of the frame. The rail ends are forced together cold under a pressure of approximately 2,500 psi before the flames are lighted. Lighting of the welding flames is done in this order: bottom, top, sides.

The welding head is suspended from a track-mounted carriage which permits it to be mechanically oscillated back and forth over the line of junction. Normally, it oscillates over a distance of 3 in. and at a rate of 40 cycles per minute; however, both the distance traveled and the number of cycles may be adjusted to other values. The actual weld is made in about 7 min (in a 112 lb rail), but an average period of 15 min is required for the complete welding operation because of the set-up and cleaning time.

Upset Metal

The continuously applied pressure gradually causes the metal as it reaches the plastic stage to upset at the joint line. A ridge of from ¼ to ½ in. high is thus formed about the joint (see Fig. 4). This loss of metal naturally shortens the length of the rail, and a scale is provided on the machine to measure the amount of the shortening. When each rail has been shortened by approximately ⅜ in. (¾ in. per weld), the welding flames are turned off, the pressure relieved and the rail is allowed to cool for one or two minutes. The signal is then given to the winch operator to pull the rail forward to the next station.

Flame-cutting is employed to remove the major portion of the ridge of upset metal. As shown in Fig. 5, a manual torch guided by a portable fixture is used. Five separate cuts are made to trim the top and sides of the ball and the sides of the base flange. The torch operator does not attempt to cut as closely as would be necessary for final finishing; his job is merely to reduce the amount of finish grinding required.

Normalizing, Finish Grinding

Normalizing is done for the twofold purpose of refining the grain of the heat-affected metal and for stress relieving. The normalizing unit has tip blocks that are similar in shape and arrangement to those of the welding head and are likewise suspended from a carriage for longitudinal oscillation. No pressure, however, is used in this operation; the joint is simply reheated to above the critical temperature (1,550 F) and allowed to cool normally in the atmosphere. The normalizing temperature is carefully checked periodically in order to be sure that the correct heat is attained so as to assure the proper completion of the metallurgical cycle. In most field set-ups the same man can do both the flame-cutting and normalizing. Together, the two operations require a trifle under 8 min—about the same time needed to make the weld.

The final operation is to grind the weld area to produce a smooth running surface and sides as shown in Fig. 6. Flexible-shaft grinders driven from a portable power plant are used, and two grinding operators are usually necessary. A hand-held vertical-wheel grinder is used to grind the sides of the ball and the edges of the base flange.

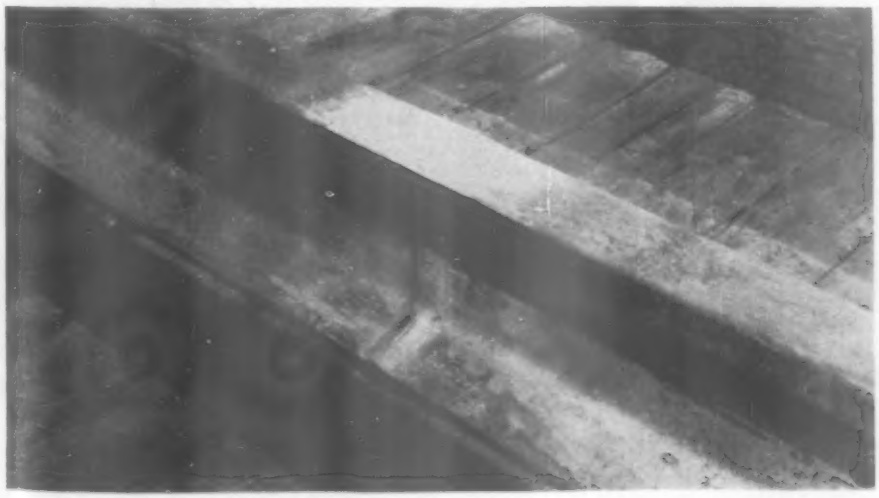
Laying the Rails

The welded strings of rails are pulled out onto flatcars or onto skids until the required number has been loaded when the long strings are hauled to the site where they are to be laid. To unload, the string may be pulled off the car by a locomotive or else its free end may be anchored and the car or skid pulled out from under it. The welded rail is barred into position and fastened to the ties in the usual manner. Obviously, it must be held down securely in order to prevent the effects of lengthwise expansion previously discussed; the methods of doing this are not difficult and are, moreover, beyond the scope of this article.

Fig. 5—A cutting torch in a portable fixture removes most of the upset metal from the base, the sides of the ball and the running surface. The web and the bottom of the base flange are usually left untouched.

Laboratory tests of 112 lb rail specimens reveal a yield strength of 70,000 psi and an average tensile strength of 130,833 psi—within 2% of the strength of the unwelded rail metal, 133,000 psi. A rolling-load fatigue test was made by rolling a load of 55,000 lb (75,000 lb for 131 lb rail) back and forth over a welded rail supported on a cantilever; this test was discontinued when failure did not occur at the end of 2,000,000 cycles.

Fig. 6—Finish grinding is done on the top and sides of the ball and on the sides of the base flange. Note the mirror smoothness of the running surface.



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Helium-Shielded Arc Welding*

By FRANCIS H. STEVENSON

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Fig. 1—Helium-shielded arc welding of a stainless steel exhaust collector to go on a Lockheed plane.

THE 18-8 type of stainless steel is used almost exclusively in the manufacture of exhaust collectors. Let us review very briefly two of the points which cause the weldor and user of this steel difficulty. These are:

1. Carbide precipitation.
2. Distortion.

How We Can Control Them

Carbide precipitation can be controlled, first, by the addition of stabilizing elements such as columbium or titanium. Even with the addition of these elements, however, some precipitation still occurs. Second, it can be controlled by the *length of time* which the steel is under the welding heat. (Note italicized words.)

Distortion can be controlled, first, by the use of suitable welding fixtures; second, by the *length of time* the part is under the welding heat.

Heat-Exchanger Fabrication

It was the common time element which led our company to start experimenting with the helium-shielded arc welding process in the early part of 1943. In Dept. 17-04 at Factory A-2, we were fabricating some experimental stainless-steel heat exchangers. The material was relatively thin, and considerable distortion was encountered. When we decided to use the helium-shielded (inert-gas-shielded) arc process, we found that the distortion was very slight and that our welding time was considerably reduced. Inasmuch as we had had considerable success in fabricating the heat exchangers by the helium-shielded process, we decided to investigate its production possibilities in the manufacture of our exhaust collectors.

Similar to Gas Welding

Fig. 1 shows a section of the exhaust collector being welded by inert-gas-shielded arc welding. This process is quite similar to oxy-acetylene welding in manipulation of the torch and rod. The arc surrounded by the helium blanket may be likened to the oxy-acetylene flame, and the addition of material from an outside source is common to both processes. In fact, we have found that a good oxy-acetylene weldor is more easily adapted to the helium-shielded process than a metal-arc weldor, probably because of the similarity of the welding technique of the two processes. The same Army weldors' qualification test is required for this process

*Abstracted from a paper presented at the annual meeting, AWS, Cleveland, Oct. 16 to 19.

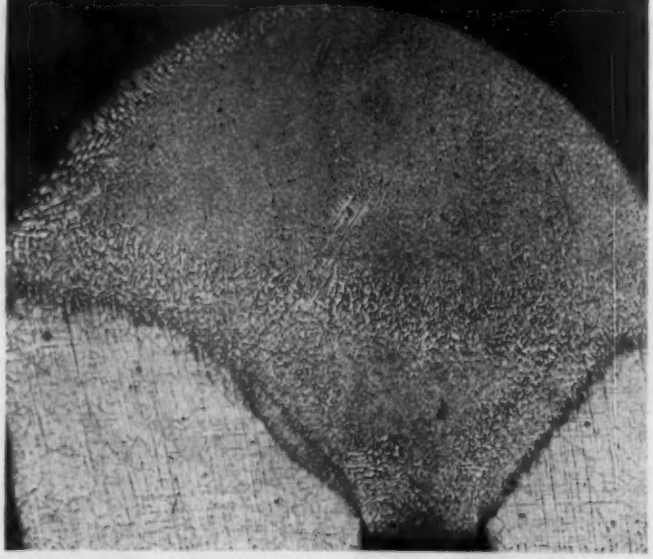


Fig. 3—Photomicrograph of a weld made with carbon-dioxide gas substituted for helium. This weld would be considered satisfactory for applications not subjected to heat in service.

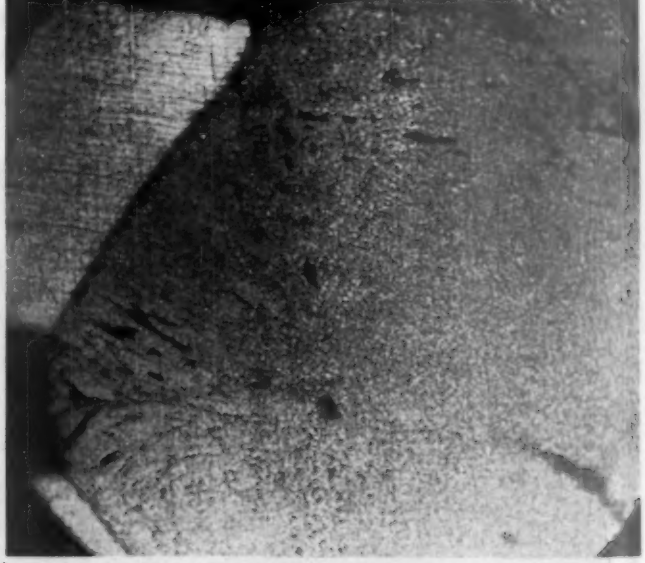


Fig. 4—The carbon-dioxide weld after the embrittlement test. Its poor quality is now evident. The weld is no longer ductile and cannot be bent without breaking.

By the use of the inert-gas-shielded welding process for stainless-steel exhaust collectors, in combination with the other points described here, Lockheed Aircraft Corporation was enabled to save $43,000 in one year.

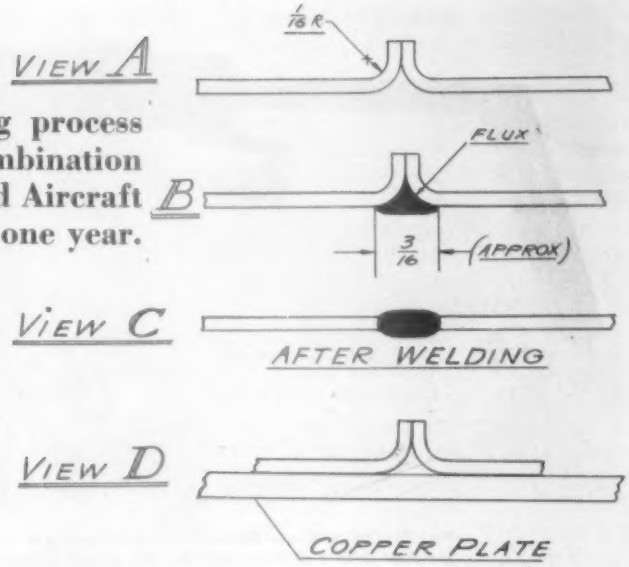


Fig. 2 — The material as flanged (A), fluxed (B), after welding (C) and with a copper back-up plate (D).

as for qualifying a weldor on the oxy-acetylene welding of stainless.

The helium-shielded process makes use of either a tungsten or a carbon electrode. In the welding of stainless steel, a carbon electrode is used with straight-polarity: electrode negative, work positive. Helium gas is allowed to flow through the torch, around the electrode and on to the molten metal, thus shielding the arc and molten metal from the atmosphere and preventing oxidation. Being an inert gas, helium will not unite in any way with the elements of the molten weld puddle.

Laboratory Test Specimens

A number of specimens were prepared, in both the columbium-stabilized (347) and the titanium-stabilized (321) stainless steel. The specimens were 4 by 6 in., 0.042 in. sheets having one 6 in. edge flanged. These parts were placed together and tack welded.

One group of specimens was coated very lightly on the underside of the weld joint with stainless-steel flux and welded with the helium-shielded arc process. The oxy-acetylene process was used in the welding of another group. Specimens were also selected and welded using a copper back-up plate without flux.

Fig. 2, view A, shows the material flanged; view B, the material fluxed; view C, the material after welding; and view D, the copper back-up plate.

The weld specimens upon which the flux was used were processed by a bath in a chemical cleaner, pickling for 20 min and sandblasting of the welded areas.

The specimens welded without flux were processed by a stabilizing heat treatment at 1,800 F for 15 min and sandblasting of the welded areas.

The specimens were cut into standard 1-in. tensile coupons and pulled to determine their ultimate tensile strengths. The variation in the ultimate tensile strengths of the coupons from specimens processed by all methods was so small that no strength advantage could be claimed for one process over the other. Table I gives a summary of tensile results.

Micrographic Analysis

Sample welds were sent to the metallurgical laboratory for weld-structure examinations and photographs. All metallurgical specimens were given an embrittlement test as follows:

1. Heating at 1,200 F for 2 hr to cause precipitation of carbides not stabilized by previous heat treatment.
2. Immersion for 60 hr in a

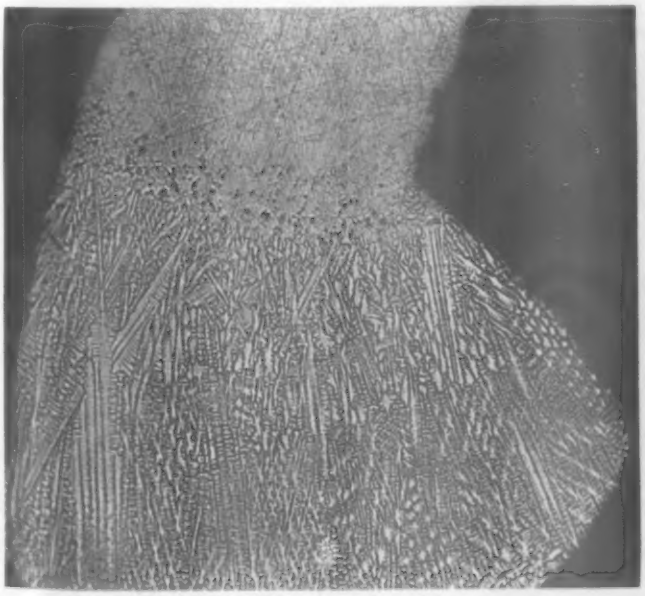


Fig. 5—This specimen was welded with a relatively low rate of travel. There is considerable carbide precipitation.

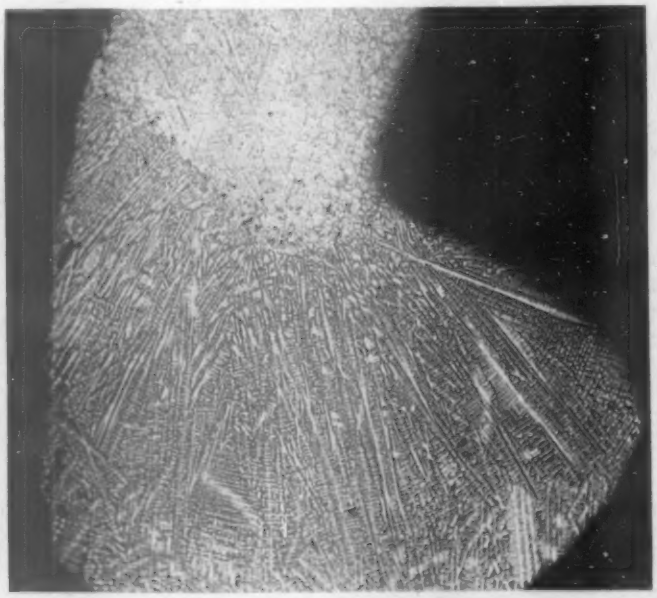


Fig. 6—This specimen was welded with a high rate of speed. It shows considerably less carbide precipitation than Fig. 5.

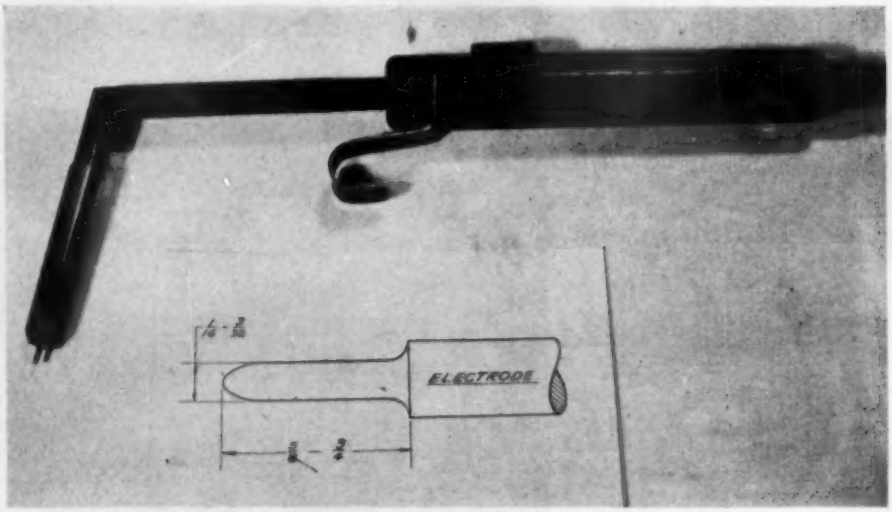


Fig. 7—The inert-gas-shielded arc welding torch was photographed with a drawing showing the shape of the electrode.

copper sulphate-sulphuric acid solution (Krupp reagent) to cause embrittlement where intergranular attack is possible because of precipitated carbides.

3. A drop test on steel plate to check for the characteristic "ring" of steel not embrittled.

4. A bend test to determine the degree to which steel subject to the above test can be bent without fracture. The steel should bend 180 deg.

After processing, metallurgical analyses and photographs, drop and bend tests were made. For comparative results the above procedure was also followed with oxy-acetylene welded specimens.

To illustrate the effect of excess amounts of carbon and the presence of oxygen while welding, photomicrographs were made of a weld in which CO_2 gas was substituted for helium (Fig. 3). The carbon burn-off from the electrode was approximately three to four times the rate obtained with helium gas. This weld has good ductility and is considered satisfactory for applications not subjected to heat in service. The poor quality of the weld after being given the embrittlement test is evident in Fig. 4. This weld did not have the characteristic ring when dropped on the steel plate. Furthermore, it was not ductile and broke immediately after starting the bend.

Rate-of-Travel Comparison

The specimen shown in Fig. 5 was welded with a relatively low rate of travel. It will be noted that there is considerable carbide precipitation near the margin between the weld material and the parent metal.

Fig 6 was welded with a high rate of speed. The photomicrograph shows considerably less carbide precipitation than Fig. 5, although the welding conditions were the same in both cases with the single exception of the rate of travel. The comparison, therefore, illustrates the desirability of shortening the period of time at which the weld area remains at high temperature.

Equipment and Technique

We use a commercial helium of 98% purity, which can be supplied by any of the well-known gas manufacturers. A helium consumption of approximately 5 liters per minute is required. It is advisable to attach a flowmeter to the standard regulator since this gives a more constant flow of helium to the torch.

The conventional d-c motor-generator arc-welding unit of 150 amp capacity is used. The helium-shielded arc torch is fitted with a carbon electrode using straight polarity (electrode negative).

Fig. 7 illustrates the shape of the electrode and shows the torch. The electrode should be allowed to extend approximately ¼ in. beyond the end of the torch tip when welding butts of standing-edge seams. A slightly greater extension is required for the welding of corner fillets.

Flange-type seams welded with a copper back-up plate should be welded in a flat position. If no back-up plate is used and weld fixtures are not available, tilt the work as shown in Fig. 1. This will help to prevent burning through by encouraging the molten material to flow in the direction of the weld.

Exhaust stack parts of similar assemblies which are made in halves and then fitted together to be welded should preferably be formed in steel dies. If all the operations cannot be performed on steel dies, at least the finish operation should be so completed. The flange should be formed with a radius of 1/16 in.; this will be found satisfactory on all gauges which would normally be flanged in this manner for welding. The flange height of approximately three times the material thickness is satisfactory and should be uniform along the entire seam. This will permit the weldor to make a much more uniform weld, with the addition of very little filler material.

Fluxing and Current Settings

A very light flux is necessary where the flanges are burned down to form a flush weld. Fluxing is not necessary for tacking, standing-seam welds, or in work where a copper back-up plate is used. However, the copper back-up plate must be clamped tightly to the underside of the joint to exclude the air and serve as a chill.

The following current settings are recommended for use with a machine of 150 amp capacity.

1. 0.058 in. thickness—60 v and 75 amp.
2. 0.030 to 0.040 in. thickness—60 v and 60 amp.
3. 0.011 in. thickness—50 v and 30 amp.
4. 0.020 in. thickness—60 v and 48 amp.

On some joints where it is not desirable or possible to use either flux or a back-up, a small copper

Table I. Summary of Tensile Test Results

No. of Specimens	Material	Method of Welding	Protection, Underside of Weld	Ultimate Load		
				High	Low	Average
16	347	Oxy-acetylene	Fluxed	3,815	3,280	3,548
16	347	Helium-arc	Fluxed	3,970	3,170	3,720
8	347	Helium-arc	Copper back-up	3,920	3,000	3,367
11	321	Helium-arc	Fluxed	3,850	3,590	3,774
4	321	Helium-arc	Copper back-up	3,900	3,635	3,759

Fig. 8—The weld fixture is made of two castings to hold the half sections of the collector ring. An air cylinder presses the sections together for welding, and a motor turns the entire fixture to the most convenient welding position.

tube may be formed to fit the joint and drilled with a series of small holes through which helium can be admitted to blanket the area.

Weld Fixtures

The original drawings for the weld fixtures were obtained from an eastern company. We have improved them as shown in Fig. 8. This fixture is made up of two castings in which each half of a section is clamped and brought together by an air cylinder. Because the castings and the finish die were made from the same basic pattern, the parts will come together without hammering or twisting. When the fixture is closed, the weldor usually tacks each end of the part before he starts welding the seams. He usually starts the welding from the center and works out. You will notice that this fixture is motorized, enabling it to be turned as welding progresses.

The parts are put into the fixture by the metal fitter and taken out when cooled. Because the parts are cooled in the fixture, no dinging is required to round them out. The ports and other openings are sized on the swage block. Fig. 9 shows a completed collector ring.

Summary

Through use as well as the previously mentioned tests, it has been determined that the helium-shielded arc process is superior to the oxy-acetylene process for the welding of exhaust collectors. The area susceptible to carbide precipitation is less because of the speed and concentration of heat plus the protective helium blanket around the weld and the rate of cooling.

It must be remembered that with this process, as with any other welding process, the parts must come to the weld shop correctly formed. Also good weld fixtures are essential. By the use of helium-shielded arc welding in combination with the above points, the Lockheed Aircraft Corp. was able to save $43,000 in one year.

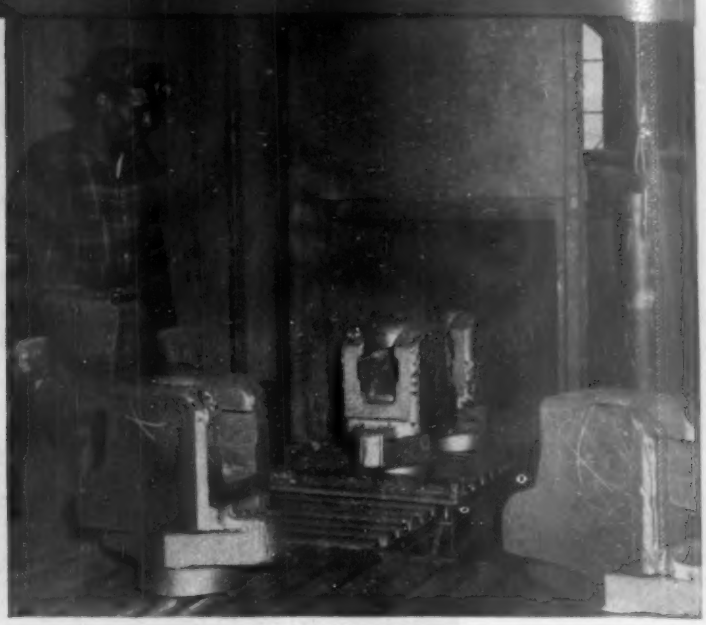
Those wishing additional information on the inert-gas-shielded welding process are referred to:

"Heliarc Welding" by Thomas E. Piper, process engineer, Northrop Aircraft, Inc., page 27, September, 1942, issue of THE WELDING ENGINEER; "Arc Welding Magnesium Alloys" by W. S. Loose and A. R. Orban, The Dow Chemical Co., page 30, December, 1942, and page 46, January, 1943, issues.

The above articles are devoted almost exclusively to the helium-shielded arc welding of magnesium and magnesium alloys. In addition to magnesium and stainless steel, the inert-gas-shielded arc welding process has also been used successfully to weld aluminum sheets. The application to aluminum will be fully covered in an article to be published in an early issue.—*The Editors.*

Fig. 9—A completed collector ring welded by the helium-shielded arc process.

After and during chipping, these castings are magnetically inspected to assure the removal of all imperfections.



Alloy-steel castings are preheated to 500 F in such a chamber as this. They are welded before they have cooled below 300 F.

By **FRANK KIPER** *and* **LAWRENCE GABES**

The Ohio Steel Foundry Co.

Welding in a Steel Foundry*

It is not our intention to imply that our welding practices necessarily are representative of those employed in all steel foundries. We do, however, believe that they are typical, to a large degree, of those found in the more progressive foundries. We have on our books orders from the Army, Navy, oil refineries, rolling mills, railroads, heat-treatment equipment builders, etc. As this paper proceeds, it will become apparent that our "know welding" men have set up practices which are easy to follow and which fulfill all specification requirements as well as accepted good practice principles.

Carbon and low-alloy steels are made in four of our five divisions, while in the fifth high alloys are made. Of the four plants, one is an acid open-hearth shop; the others are acid electric shops.

Heat-Treated Welds

In the carbon and low-alloy steel shops, the alloy steels are kept separate from the carbon steels for the purposes of welding and heat treatment. Alloy-steel castings and those carbon-steel castings having 0.35% or more carbon are preheated to 500 F and welded before they have cooled below 300 F. All welding is done after the castings have had a preliminary normalize or anneal and before the final heat treatment. If a defect appears after the final heat treatment, the casting is again preheated, welded and stress relieved. In the case of a major weld the casting receives a complete reheat treatment.

Carbon-steel castings are welded either before the normalize or before the draw. This practice assures us of stress-relieved welds in all cases and of heat-treated welds in almost all cases. We have found this practice to be well worthwhile from the standpoint of eliminating hard spots and rendering our castings more machinable.

Another practice we have established is the rough machining of castings prior to welding. This removes many surface imperfections and consequently reduces the amount of surface welding.

The North Plant

Our North Plant is a specialty shop where many of the breech rings for the Army's guns (up to the 8 in. size) are produced. The steel is produced in a 15 ton acid electric furnace. It is aluminum killed and of a medium manganese-molybdenum analysis. Other high-grade alloy-steel castings, including spring seats for tanks and gun component parts such as yokes, are also produced in this plant.

The castings for the breech rings are first inspected visually, and their defects removed by chipping and grinding on conveyor lines under inspection. The castings are next magnetically inspected with a 600 amp machine surging to 900 amp. After the inspector is satisfied, the castings are conveyed to a preheat chamber 36 by 36 in. by 20 ft long. Here the castings are brought to 500 F by soft natural-gas flames. The castings are pushed through by an air jack, and the preheat cycle takes about 40 min.

Welding Booths

From the preheat chamber the castings are pushed down a conveyor to the welding booths. These are equipped with 400 amp motor-generator-type welding units and an exhaust system for the removal of welding fumes; above each booth is

*Abstracted from a paper presented at the annual meeting, AWS, Cleveland, Oct. 16 to 19.

Above: The welding booths are at the end of the preheat chambers. Note the electric hoist and the exhaust tube servicing each weldor.

Right: Welding a 75 mm breech ring. The casting is positioned for flat welding, and the operator has a hammer and wire brush at his finger tips to clean the slag from each bead.

The difference is vast between the comparatively few men who know welding and the many others who merely know how to weld. In this steel foundry, castings vary in weight from 2 oz to 50 tons. The "know welding" men set up the practices; the others have only to follow.

located a cross-travel, one-ton electric hoist for use in positioning the castings so that all welding may be done in the flat position. This particular weld line employs 12 weldors.

A carbon-moly (50 moly) heavy-coated electrode is used. The standard sizes are $\frac{3}{16}$ and $\frac{1}{4}$ in., but some $\frac{1}{8}$ in. rods are used on thin sections. This particular electrode may be used either on straight or reversed polarity, depending upon the type of weld being made and the operator. Most of the welds are made with reverse polarity.

The inspectors, who have access to the welding booths, will send back to preheat any casting which has cooled to below 300 F (as checked by a 300 F temperature-measuring crayon) before welding. The welded castings are allowed to cool to room temperature in still air. The welds are then dressed by chipping and grinding, and the castings sent directly into the heat treatment. After heat treatment, the welded areas are again magnetically inspected to make sure no breech ring or other high-quality casting gets to our final line with a defective weld in it.

A slightly different set-up is used for another type of casting. A large number of valve bodies and like castings are produced in the North Plant. The bodies range in size from 8 to 24 in. and from 150 to 1,500 lb. The high-pressure valve bodies are made of low-alloy steel and are preheated to 500 F before they are welded with carbon-moly electrodes. The low pressure (300 lb and under) valve bodies are welded with low-carbon steel, straight-polarity electrodes. The welding is done by six welding operators, and 300 and 400 amp motor-generator sets are used.

The South Plant

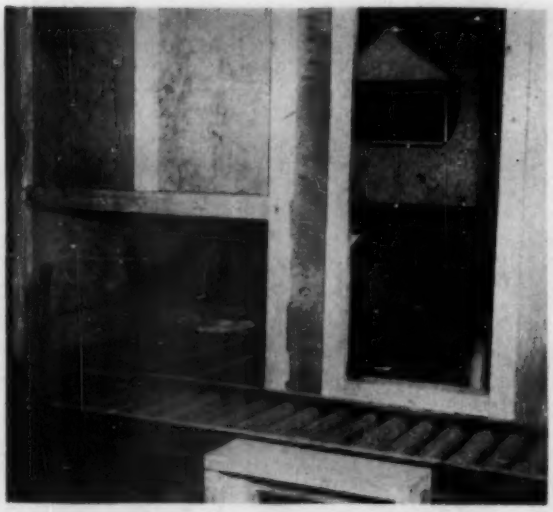
The South Plant is a small castings plant, producing large numbers from a few patterns. Since individual castings weigh only a few pounds, they are easily handled, and most of the welding can be done by women. In addition to carbon steel, a modified NE 9430 steel (nickel-chrome-moly) is used. The alloy and carbon-steel castings are kept separate for welding and heat-treating purposes. All carbon-steel castings are prepared for welding by chipping, inspected and then loaded on skids for conveyance to the welding booths.

The booths are constructed of plywood and are approximately 9 by 10 ft by 8 ft high. Each booth is equipped with an exhaust system. A roller conveyor runs along each side of the booths, and a cross-over section runs through each booth. Every operator has a 400 amp motor-generator welding set at her disposal.

The castings are usually removed one at a time from the skids, welded in a jig and placed on another skid. When the latter is filled, it is pushed outside the booth to the chippers and weld dressers. The welding is done with $\frac{5}{32}$ in. electrodes of the carbon-steel, heavy-coated straight-polarity type. Each operator welds between 700 and 1,000 castings per 8 hr day and uses an average of 150 electrodes. The alloy-steel castings follow the above procedure except that they are preheated to approximately 500 F and are welded with $\frac{3}{16}$ in., reverse-polarity carbon-moly electrodes.

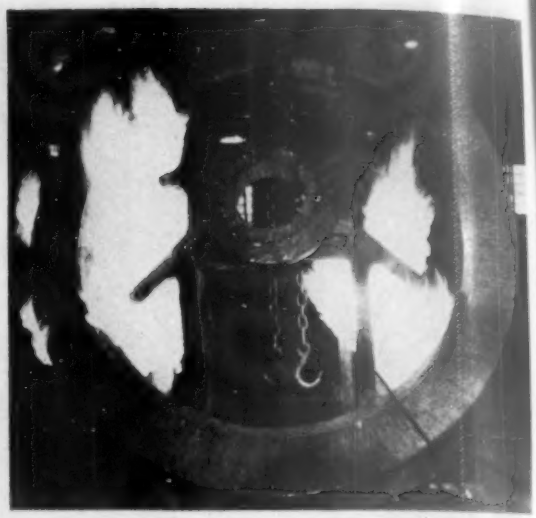
Springfield Plant

What has been said of the South Plant might also be said for the Springfield Plant with a few exceptions. The Springfield Plant is an acid electric plant producing aluminum-killed carbon-steel and alloy-steel castings. There is a large number of patterns being run at all times



Left: One of the welding booths for small castings. Every booth is serviced by conveyors and is equipped with an exhaust system for welding fumes.

Right: Keeping up the temperature of a large casting for welding. Whenever the temperature falls below 300 F, large natural-gas flames are allowed to play on the casting to restore the preheat.



as well as a greater variety of alloys than in the South Plant. The welding technique, however, is the same—conveyor line production, preheat chambers and continuous heat-treating furnaces. Motor-generator welding units are used, and the coated electrodes are the same as at the South Plant.

Central Plant

The Central Plant is the acid open-hearth shop, producing miscellaneous castings such as power shovel and locomotive parts as well as rolling-mill rolls and large refinery pipes. The castings vary in weight from 55 lb to 50 tons and are of such varied sizes and shapes as to render them unsuitable for the production-line system. The smaller ones, however, are worked on rail skids on benches. One inspector and one weldor are stationed at each group of six chippers. This enables the inspector to pick out the alloy castings for preheating as well as to inspect them both before and after welding.

The larger castings are worked on the floor under the eyes of an inspector. Where possible the defects are removed by air-hammer chipping, but when necessary the flame gouge is employed. Flame-gouging is always followed by chipping in order to make sure that both the defect and the slag from gouging are removed. A conscientious effort is made to do as much welding as possible in the flat position. Jib cranes and bridge cranes are used for positioning; due to the design of some of the castings, however, some vertical welding is necessary. This welding is done by the weave technique. Heavy-coated electrodes are used, ⅛ to ¼ in. sizes.

Refinery Fittings

Large, high-pressure, alloy-steel refinery fittings and pipes are repaired by the same procedure that is used on breech rings: the defects are first removed under magnetic inspection, the castings are preheated to 500 F and welded before they have cooled to below 300 F. In the case of large castings the temperature is maintained by means of natural-gas flames and asbestos coverings. Welding is done by stringer or weave technique, depending upon the size and position of the defect. After welding, the casting is given its final heat treatments; the welds are dressed by chipping and grinding, and the castings are again subjected to magnetic inspection. These castings generally undergo also a hydrostatic test of 1,000 lb for 24 hr.

Welders and Weldors

The welding machines used in the Central Plant are 400 and 600 amp motor-generator units. There are 36 weldors employed. Two carbon-steel electrodes, one straight and one reversed polarity, and four alloy electrodes are used with regularity. The average monthly consumption is 13,000 lb of electrodes.

The high-alloy steels are produced in two acid-lined electric furnaces, one of 1,000 lb and one of 500 lb capacity. Many analyses are made, the most popular of which are 18-8, 25-12 and 25-20. A great deal of care has to be exercised in selecting electrodes for welding these materials, but there are many on the market today which do a satisfactory job. An understanding of the material being welded is equally important. Our general practice is to select a rod which will produce a weld to match the parent casting. We use flux-coated rods so as to avoid oxidation losses during welding. Reversed polarity is employed in all cases, and the current setting is as low as is consistent with good penetration.

Our welding personnel ranges from beginners to veterans of 30 years' experience. A training school is conducted under the State Vocational Educational Program. The beginners are first taught on scrapped steel castings. After they have mastered the fundamentals, they are put on the floor under competent welding foremen to do relatively unimportant work until they get the feel of welding in the shop. From this point on a weldor progresses at his own rate. Every weldor is given a test every 6 months.

The breech-ring castings are magnetically examined again after welding and must also undergo final inspection by a representative of the Ordnance Department.

Two-Million-Volt X-Ray Tube

Only a few short months ago we were marvelling at the use of the million-volt X-ray in the radiographic inspection of thick steel sections. Now comes a precision X-ray tube of *two* million volts.

DEVELOPMENT of a precision X-ray tube that operates at two million volts was revealed on Sept. 27 by Machlett Laboratories, Inc., Springdale, Conn. This tube makes it practicable to inspect exceedingly thick sections of metal by X-ray. (Formerly the maximum steel penetration in practicable exposure time stood at about 8 in.) For instance, a section that required a week's exposure time with the million-volt machine was radiographed in less than an hour with the new two-million-volt tube.

An Old Name

The name of Machlett has been associated with X-rays since a few years after their discovery in 1895 by Konrad Roentgen. Robert Machlett (1872-1926) constructed the first practicable X-ray tube made in America. Today numerous physicists, chemists, engineers and other specially trained technicians in the Springdale and Norwalk plants of Machlett Laboratories devote their combined talents to the design and production of X-ray and electronic tubes. The development of the two-million volter was undertaken at the Springdale plant for use by the high-voltage laboratory of the Massachusetts Institute of Technology and required more than two years of research and experimentation.

Fundamental Requirements

(*a*) Operation was to be at a minimum of two million volts d-c, to be supplied by an electrostatic generator. The high voltage was required to achieve practicable exposure times in the investigation of heavy steel objects; the constant potential was necessary in order to obtain and maintain extremely fine focusing of the X-ray beam and to reduce the heat generated at the focal spot.

(*b*) So that the X-rays would emanate from practically a point source, the focal spot was required to be only a few thousandths of an inch in diameter. Small focal spots have long been recognized as advantageous, and the geometric problems involved in the radiography of thick sections made necessary a spot very much smaller in size than any that had previously been achieved.

(*c*) The tube had to be able to withstand external air pressures of from 200 to 400 psi. The high-voltage generator in which the tube is used employs air at high pressures as an insulating medium.

(*d*) The tube had to be compact and completely sealed-off, like a radio tube, so that its high vacuum would not need to be maintained by continuous pumping.

Sectionalized Construction

To achieve the required extremely fine focusing of the electron beam necessitated not only an improved electron source but a new means for accelerating the movement of the electrons. The latter was required to provide a constant rate of acceleration over the entire cathode-to-target distance and at the same time reduce the dispersion of the beam during its travel to an absolute minimum.

To accomplish the above, the tube was designed in a large number of accelerating sections. The optimum was found to be some 180 sections, which provided uniform accelerating steps of 12,000 volts each. The mechanical problems involved in the design and construction of such a column of alternating glass and metal rings were tremendous: each section had to be tight to the vacuum within, able to resist the high pressures from without and have adequate electrical insulation. These requirements were almost insuperable obstacles in the light of what was then known of the art of tube construction.

300 Ft of Seals

In order to appreciate the magnitude of the task, it may be pointed out that the total length of glass-to-metal seals in the average X-ray tube is from two to three inches. The two-million-volt tube required approximately *300 feet*—over a thousand times the length of such seals in even the larger standard tubes.

Even under the most carefully controlled manufacturing conditions, leaks in the seals were considered remarkably low at one leak per 300 in. —to produce 300 ft of leakproof seals in a single tube meant that something like a miracle would have to occur. It just simply couldn't be done, according to all previous experience.

The high external air pressure under which the tube operates introduced an additional complication. The rate of leakage is an exponential function of the pressure of the form $L = KP^a$, where L is the rate of leakage, P the pressure and the exponent a a variable (greater than 1, usually less than 2) dependent on the size of the orifice, the kind of gas, temperatures involved, etc.

Bear in mind that the column is required to be operated at pressures in excess of 200 psi and that one leak of the very smallest size would render unusable the section in which it occurred.

New Sealing Technique

Early in the experimental work, it became evident that the usual gas-flame technique for sealing metal to glass wouldn't do. Eventually a novel procedure was developed; it involved a combination of gas flame and high-frequency induction heating. The metal rings were made of Kovar and were given a special configuration to assure complete and homogeneous bonding with the glass. Special means were also devised to detect and eliminate small strains within the glass.

The development of this two-million-volt precision X-ray tube, its makers claim, brings to the field of X-ray inspection the same sort of improvement that the electron microscope brought to the field of optics.

President Raymond R. Machlett of Machlett Laboratories, Inc., and his company's new two-million-volt X-ray tube. Mr. Machlett is the son of a famous pioneer in X-ray tube manufacture.

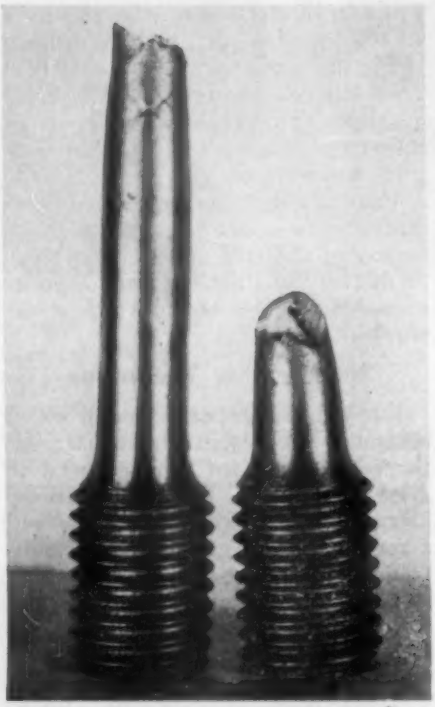
★ INSPECTION

Shall We Qualify the Operator?

Specifically, should we requalify him when he changes from one AWS electrode classification to another? AWS Tentative Standards say that it is not necessary, but a different story is told by the tests described here.

By **DR. W. A. PEARL**

Whiting Corporation



A 0.505 in. diam tensile specimen made entirely of deposited weld metal affords the best check of an electrode.

THE purpose of the investigation to be described was a study of one variable of the Tentative Standard Qualification Procedure of the American Welding Society as of April 25, 1941. These standards were prepared by two committees to clear the way for a standard qualification procedure which industrial concerns might adopt for the qualification of weldors and welding material. Our group* at Illinois Institute of Technology chose for research variable number four: "A Change in Filler Metal from one American Welding Society Classification Number to Another."

The question to be decided was whether this change should require a requalification of the operator in view of the fact that the tentative standards specify that a change in electrode classification shall require only the requalification of the procedure.

Test Specifications

The method of test was to obtain a standard weldment from various qualified weldors who were for the test purpose using a qualified electrode unfamiliar to their usual practice. This weldment was assumed to be a representative sample of the weldor's ability, and it was tested to discover whether or not it would meet the AWS minimum requirements (Table I) for the material deposited.

Twelve operators were chosen from five industrial concerns in the Chicago area. Each operator was required to be a qualified weldor on one AWS classification number chosen from an arbitrary three but unfamiliar with the other two. The three electrodes chosen were E-6010, E-7010 and E-6012.

The test pieces were composed of two 12 by 5 in. SAE 1020 steel plates of either ⅜ or ¼ in. thickness. Butt welds along the 12 in. length were made with or without backing strips, at the discretion of the weldor. The plates were prepared for welding by machining a 30 deg bevel on each side, resulting in a vee groove having a 60 deg included angle.

The welds were performed as horizontal bench welds, using the standard stock electrodes of four manufacturers. Any one of the four commercial electrodes specified might be used for each AWS classification number. The minimum requirements with regard to tensile strength, yield point and elongation in 2 in. minimum for electrode classifications E-6010, E-6012 and E-7010 are given in Table I.

X-Ray and Tensile Tests

The first test performed on the welds was that of the U. S. Army Ordnance Department Tentative Specification AXS-476 for the Radiographic Inspection of Welds. Radiographs were made by an X-ray machine of 200 kvp capacity on a non-screen film. The radiographs had a density range of 1.4—2.0 in the weld metal section and penetrameters (as required by the Army-Navy Aeronautical Specification AN-QQ-M-188) were plainly visible. Weldment failures were judged according to the borderline failure plates in Specification AXS-476. In cases of indecision the weld was passed.

The next test to be made was the tensile strength of the weld. Test specimens were flame-cut from the plates that had successfully passed the radiographic test. (Plates that had failed to pass were not considered further.) After flame-cutting, the test specimens were machined according to the standards recommended by the AWS Tentative Standard Qualification Procedure.

To make the actual test, a self-

Table I. AWS Electrode Specifications

Electrode Classification No.	General Description	Treatment of Welded Specimen	Tensile Strength	Yield Point	Elongation in 2 in. Min.
E-6010	Heavy covering, useful with d-c, electrode positive only	NSR*	62,000	52,000	22%
E-6012	Heavy covering, usually used with electrode negative, d-c or a-c	NSR	62,000	52,000	17%
E-7010	Heavy covering, useful with d-c, electrode positive only	NSR	72,000	62,000	17%

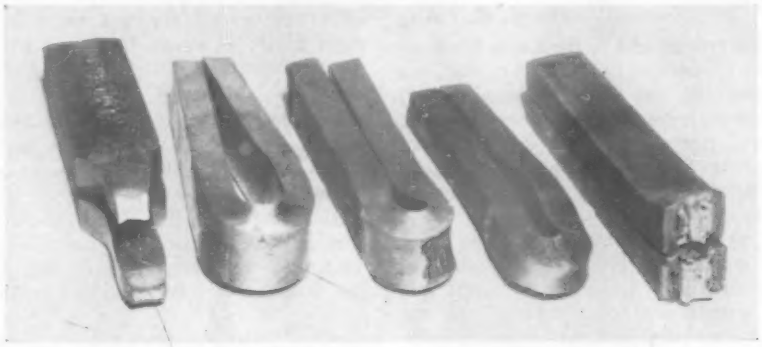
Source: Tentative Specifications for Iron and Steel Arc Welding Electrodes-Serial Designation A233-42T-1942.

*Not stress relieved

* R. B. McCauley Jr., Peter Jasis, Robert A Kraus, Joseph Rising Jr., Alex Toth.

Table II. Results of Radiographic, Tensile and Ductility Tests

Test No.	Plate Thickness, In.	Test Welding Electrode	Operator Qualified on Electrode	Radiographic	Tensile Test, psi	Failure Occurred	Tensile Strength Table I	% Elong.	% Elong. Table I
0	3/8	E-6012	E-6010	Porosity failure					
1	3/8	E-7010	E-6010	Porosity and lack of fusion failure					
2	3/8	E-7010	E-6010	O.K.	70,050	Plate	72,000	10.0	17
3	3/8	E-6012	E-6010	O.K.	71,000	Plate	62,000	8.3	17
4	3/4	E-7010	E-6010	O.K.	58,000	Plate	72,000	20.8	17
5	3/4	E-6012	E-6010	O.K.	55,800	Weld	62,000	25.0	17
6	3/4	E-7010	E-6012	O.K.	52,700	Weld	72,000		17
7	3/8	E-7010	E-6010	O.K.	64,200	Plate	72,000	25.0	17
8	3/8	E-7010	E-6010	O.K.	81,800	Plate	72,000	20.0	17
9	3/8	E-7010	E-6010	O.K.	65,000	Plate	72,000	25.0	17
10	3/8	E-6012	E-6010	Undercut failure					
11	3/4	E-6012	E-6010	Lack of fusion failure					
12	3/4	E-6012	E-6010	Porosity failure					
13	3/4	E-7010	E-6010	Slag. incl. failure					
14	3/4	E-7010	E-6010	Slag incl. failure					



Several types of tests are needed to determine the quality of a weld. Left to right are shown a tensile specimen, three "ductility" bend specimens and a nick-break specimen.

recording tensile machine was employed, care being exercised to maintain the griffin jaws well away from the metal. The results of these tensile tests are recorded in Table II.

Ductility Test

The third test applied to the welds was that of ductility as determined by the free-bend method. As before, the test specimens were prepared in accordance with the Standard Methods for Mechanical Testing of Welds. From each test plate studied samples were flame-cut to a width 1½ times the plate thickness plus ¼ in. After flame-cutting, ⅛ in. was machined from each edge of the sample, reducing it to the final width of exactly 1½ times the plate thickness. The weld reinforcement was machined flush with the parent metal, and the face of the weld was ground on a surface grinder to free it from all tool marks. A circle was then lightly scribed on the face of the weld; this circle was approximately ⅛ in. less in diameter than the width of the face of the weld.

A steady load was applied by means of a testing machine to give a final bend to the specimen. The machine was immediately stopped when a crack appeared in a surface of the material; if no crack appeared, the specimen was bent 180 deg. The final elongated diameter of the circle was measured, and the percentage of elongation was calculated by the formula:

$$\% \text{ Elong.} = \frac{D}{\text{Orig. Diam}} \times 100$$

where D = Final Diam − Orig. Diam.

Results

The results of the entire study are compiled in Table II. It should be noted that out of 15 tests, only eight passed the initial X-ray inspection. Of the eight, only two had tensile strengths above the minimum requirements given in Table I. And of these two, but one had a satisfactory percentage of elongation.

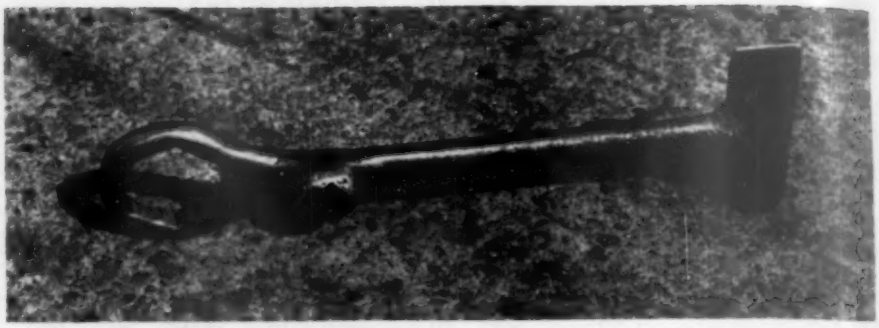
"Shall we qualify the operator when he passes from one AWS electrode classification to another?" In view of the results revealed in Table II, the answer should be an unhesitant "Yes."

VITAL TO VICTORY! *Spot welding is used to join delicate parts of an ultra high frequency transmitting tube at the Dobbs Ferry plant of North American Philips Co., Inc. Grids for such tubes consist of many fine wires which must be aligned perfectly or communications equipment for our fighting men will not function properly.*

Short Cuts and Kinks...

. . . To the Cause of Victory

A few of the many time and labor-saving ideas developed by tacticians of the production line are presented every month in this department. If you have a good welding idea of your own to pass along, you are hereby invited to contribute it to the cause of victory. Send anything you think suitable to: Short Cuts and Kinks, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5.



Hammer-and-wrench combination for flame-cutters. The hexagonal opening is used to remove cutting tips; the square socket in the center for cylinder valves.

"Positioned" Pipe Welds

By W. F. Schaphorst

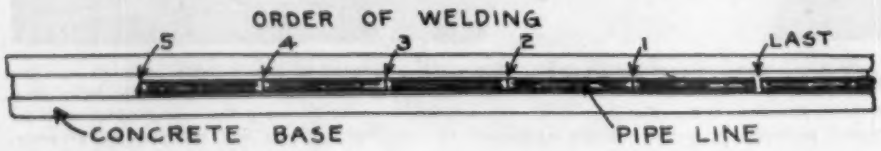
WELDING in modern manufacturing plants has been greatly speeded and improved in quality by the creation of a machine called the "positioner" by some and the "manipulator" by others. As readers of THE WELDING ENGINEER well know, this device is a sort of gigantic lathe faceplate to which the work is fastened and rotated by mechanical or manual means around to whatever position is most convenient for the weldor.

The drawing reproduced below shows how the principles of the positioner can be advantageously copied to expedite the welding of pipe joints. The thing to do is to turn or "position" as much of the piping as possible so that the welding can be performed conveniently from above. In other words, don't "get under" at every joint.

Let us say that you are welding from the right and toward the left. The piece of pipe at the extreme right is rigid and cannot be turned. So wait a while before welding the joint marked "Last" in the sketch. Begin by welding 1, then 2, 3, 4, 5, etc., positioning the work by turning the pipe as long as it is possible for you to do so.

Work of this kind is sometimes performed on a concrete base as indicated, particularly in connection with power plant heating jobs. Where pipe runs are long and straight, nearly all of the joints can be positioned in this manner. But it is well worth while to bear this positioning method in mind even for jobs where there is no concrete base and the grades are variable. It is a great time, money and energy saver.

Easier pipe welding. Don't weld the joint to the rigid section at the extreme right until after joints 1, 2, 3, 4 and 5 have been completed.



Slag Hammer and Wrench

By A. R. Long

I SUBMITTED an idea to the Labor Management Committee of Kaiser Co., Inc., for combining the two wrenches used by all flame-cutting operators with a slag hammer. Formerly, the cutting tips were removed from torches by applying any wrench handy. Often the wrench would slip and mar the exact fit of the bushings.

My new device includes a hexagon-shaped wrench which will grip all sides of the cutting tip securely. The opposite end of the wrench is a slag hammer, and the center has a square socket to fit the cylinder valves. Thus three uses are combined into one easily carried, compact unit.

This combination tool offers four advantages: (1) the danger of leaks in cutting tips is reduced; (2) the six-sided wrench grip will not mar the metal; (3) the wrench will not slip off; (4) three tools are readily available when wanted.

» «

Welded Dipping Rack

A COMPACT, lightweight rack for dipping and drying was easily made from a few pieces of thin-gauge sheet metal, some flat stock, angle iron and a length of 6 in. pipe. The rack is used for dipping rotor parts of an electric generator in an insulating liquid and draining them during the drying period.

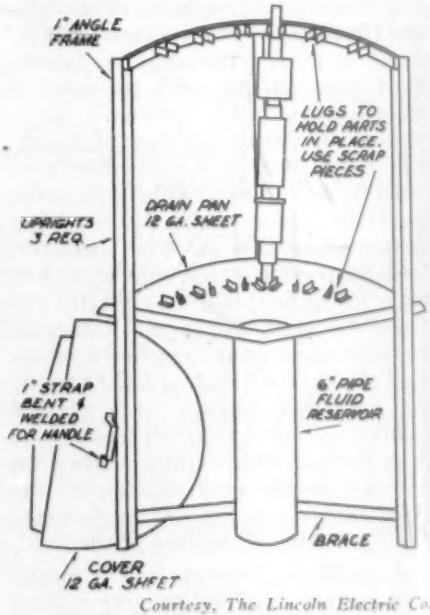
The lower section of the structure forms a drum-shaped reservoir for the insulating liquid. The central member, a 2½ ft. length of 6 in. pipe, is plugged at the bottom by a circular piece of flat stock. The latter is cut to the same size as the pipe's ID and welded all around to the pipe end.

The top, the draining portion of the rack, is a cone-shaped section of 12 gauge sheet steel having its forward edge bent at right angles as shown by the sketch. This piece is fillet welded to the top edge of the pipe.

The framework enclosing the structure is made from three 1 in. angles and reinforced with three short lengths of angles, horizontally welded to the central pipe, and vertical angle members. The top piece is a 1 in. piece of flat stock bent and welded to the top of each upright. Small lugs to hold the rotor shafts were welded to the top piece.

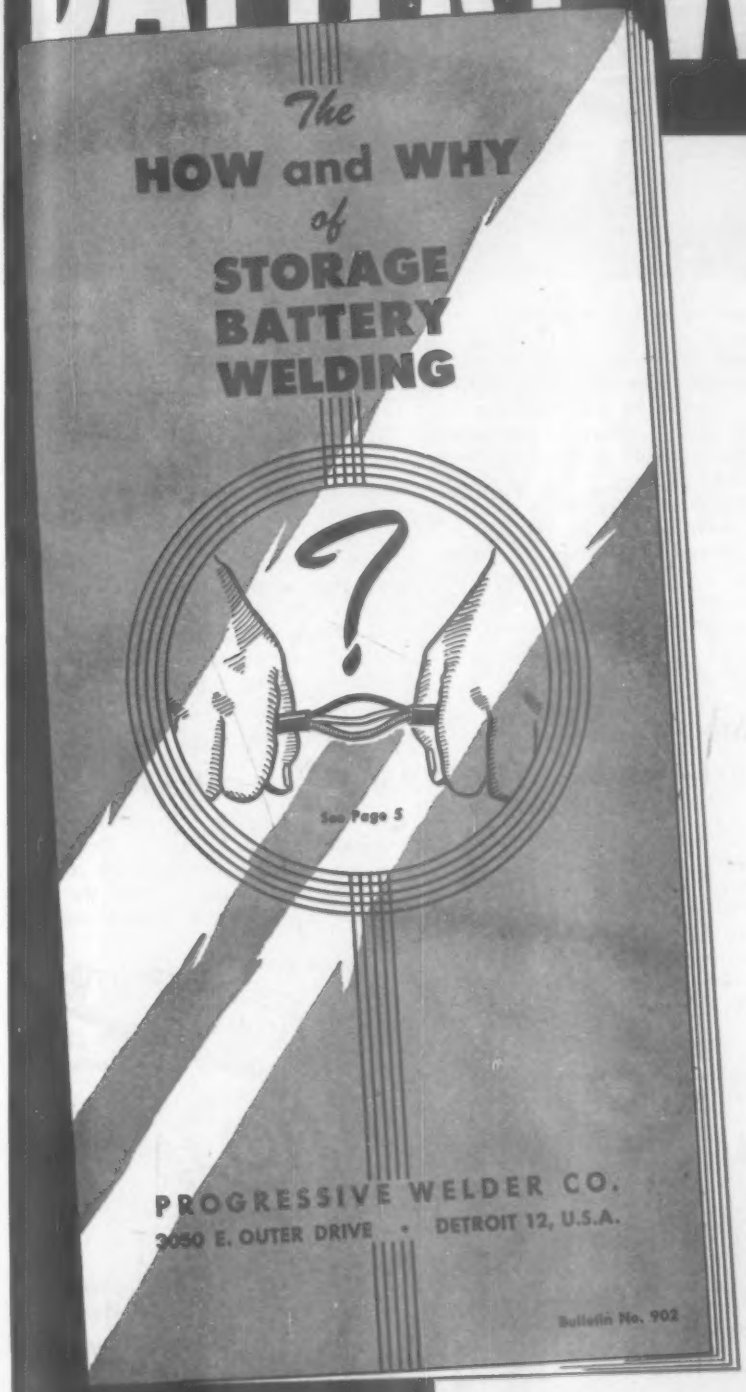
A lid for the rack (left of sketch) was made of two pieces of 12 gauge sheet; these were cut and welded to form a tight enclosure for the tank and draining pan. A handle for this lid was made by bending a 1 in. strap to U-shape and welding it to the surface as shown.

Construction details of a dipping and draining rack to facilitate the production of electric generator parts.


1" ANGLE FRAME
LUGS TO HOLD PARTS IN PLACE. USE SCRAP PIECES
DRAIN PAN 12 GA. SHEET
UPRIGHTS 3 REQ.
1" STRAP BENT & WELDED FOR HANDLE
6" PIPE FLUID RESERVOIR
BRACE
COVER 12 GA. SHEET

Courtesy, The Lincoln Electric Co.

BATTERY WELDING



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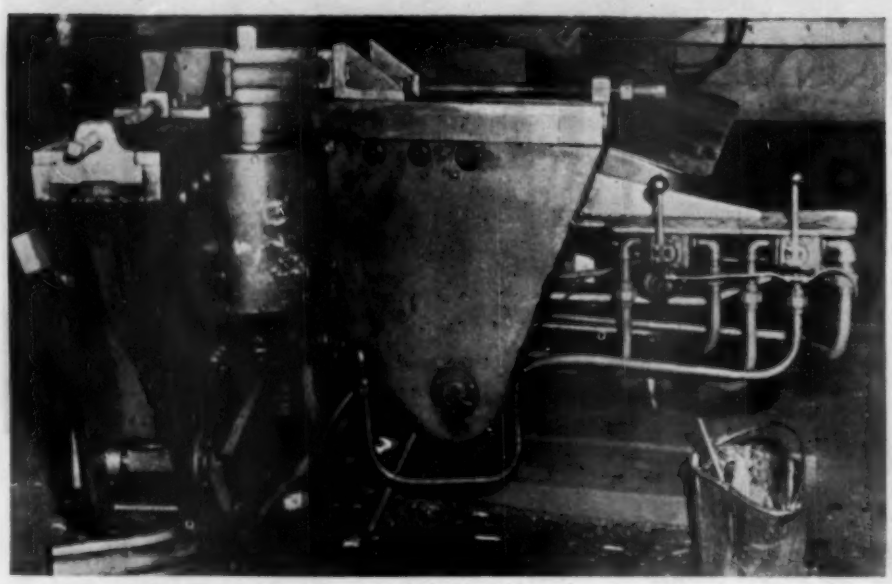


Remodeled hydraulic bender permits cold bending of pipe up to 2 in. in diam.

Pipe-Bending Machine

By Arthur J. Pond

Alabama Dry Dock & Shipbuilding Co.

THERE are several places on a ship where pipe ends have to have what is known as a short bend. Until recently we bent all piping by the "hot bend" method. The pipe was packed with sand, plugged at both ends with wooden plugs and heated on a hot slab. It was then bent to a template.

I suggested to the Labor-Management Committee an improvement on the hydraulic pipe bender, which suggestion was accepted. The improvement involved the remodeling of a hydraulic pipe-bending machine by milling out the shoes and wheels for a coupling. The latter is screwed on the end of a threaded pipe before it is placed in the machine for bending. A short bend on the pipe end can thus be made cold on all pipe from ¾ to 2 in. in diam. The sand packing and hot bending are eliminated, resulting in a direct labor saving of approximately 125 man-hours per ship.

» «

Mash-Welding Die

By Robert Mulcahy

International Harvester Co.

IT HAD been our general practice to heat and preform the radiator frame tie rods we make for half-track vehicles. The rods were then assembled in a welding fixture and arc welded into an assembly. Very often the distortion caused by the arc welding would necessitate hand straightening.

I suggested a mash-welding die for radiator tie rod assembly to eliminate: (1) arc welding, (2) preforming of rods and (3) setting them to gauge after arc welding. The rods are now left straight and are assembled in a fixture which is attached to the mash-welding die in a projection welder. They are then mash welded together while all four ends are held in their required positions.

This suggestion was accepted by the War Production Drive Committee. It has resulted in a production increase of 500%, saved welding rod, improved the quality of the final assembly and has also greatly facilitated assembly into the completed half-track.

» «

Pipe-Welding Positioner

By D. G. Rokes and H. T. Shields

Consolidated Steel Corp., Ltd.

OUR pipe welding was usually done on a table or on the ground, requiring the weldor to move each pipe several times before a weld could be completed. To speed up production and make the welding job easier, we suggested a jig for the position-welding of pipe. This idea was adopted by our Joint Labor-Management Committee, and its use has resulted in a saving of 200 man-hours per hull.

This jig positions pipe in all sizes up to 18 in. diameter.

The jig's axle revolves on ball bearings for easy turning. Collector brushes are used to eliminate any electrical arcing which might scar the bearing on which the jig is rotated. The faceplate is made to handle pipe up to 18 in. in diameter.

The jig positions the work so that all welds can be made in a flat position. In addition, the weldor can now rotate pipe without having to change his working position. The use of this jig enables us to turn out faster, better pipe-welding jobs.

» «

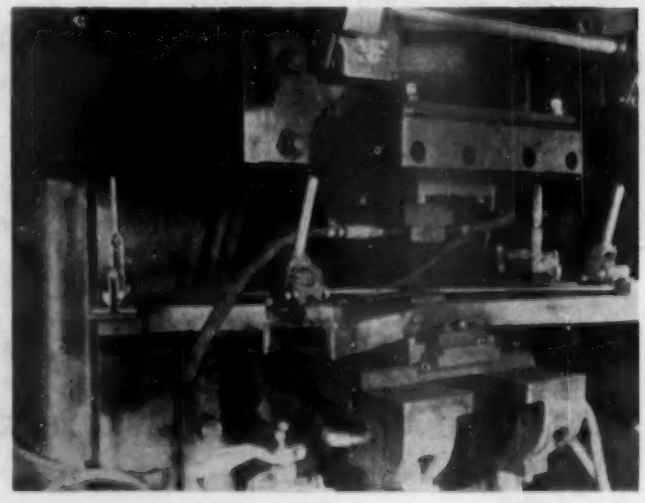
Cutting Lever Latch

STANDARD cutting torches are usually equipped with a latch to lock the cutting-oxygen valve open for long cuts. This convenience is missing from the cutting attachment used on a welding torch, but, as the sketches show, a home-made latch can be easily fabricated from an ordinary garden-hose clamp. The clamp should have an ID fitting loosely over the torch handle. In operation, it is slid forward over the end of the lever in order to hold the valve open.

Courtesy, The Linde Air Products Co.

Garden-hose clamp used to hold the cutting-oxygen valve open. This device is used with the cutting attachment of a welding torch.

Below: Radiator tie rods are mash welded together by means of this projection welder die.



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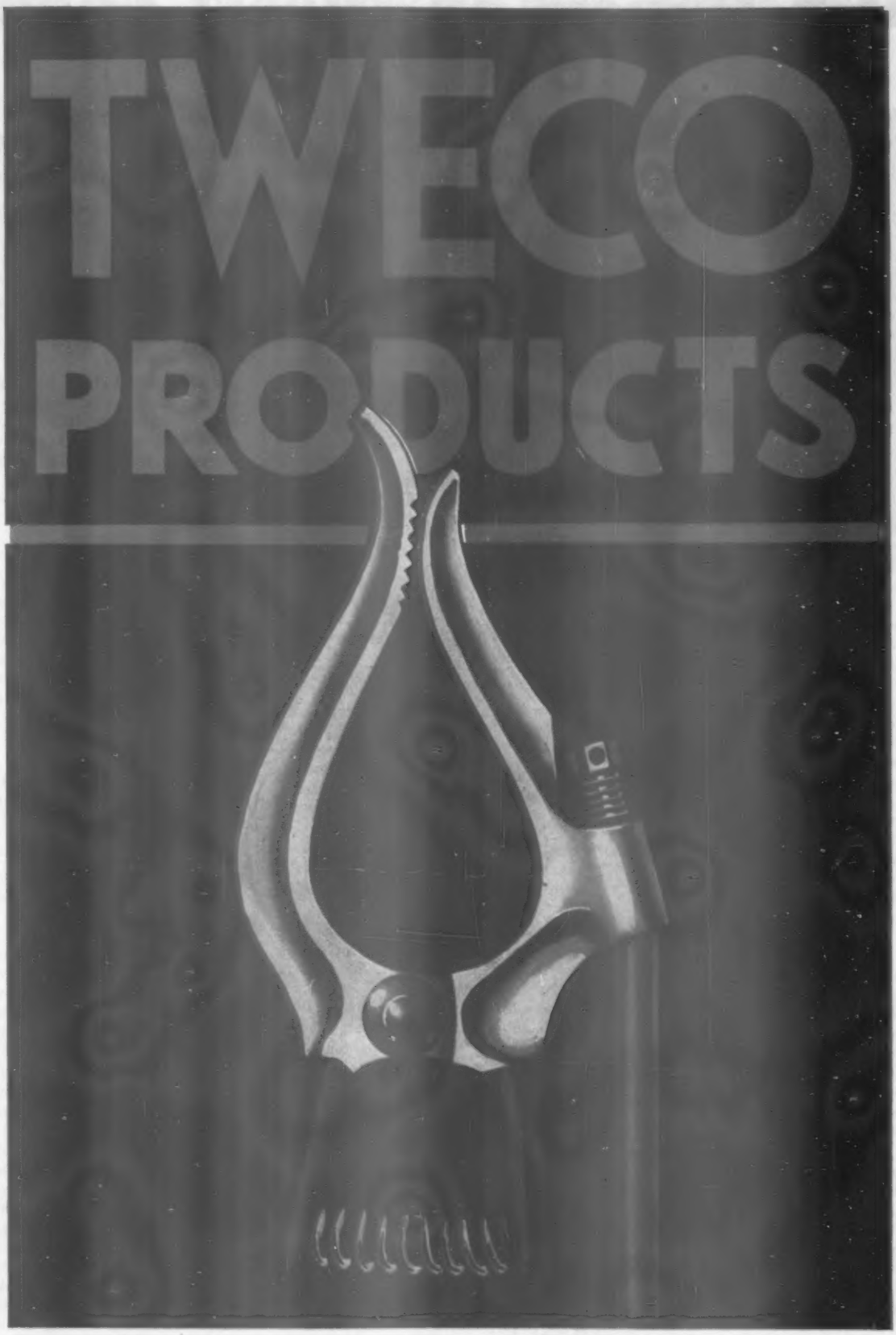

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AWS Papers in Digest Form

A variety of technical papers was presented at the 25th annual meeting of the Welding Society. Most of the more important of the 57 papers which were given at Cleveland have been abstracted for this summary.

Multiarc Welding of Aluminum Alloys

By M. R. Rivenburgh *and* C. W. Steward
Curtiss-Wright Corp.

Multiarc welding is a process developed by the metal fabrication section of the Curtiss-Wright Corp. research laboratory to make possible the arc welding of relatively thin sheets of aluminum alloy.

The essential elements of the process are: a twin-carbon torch, a heavily coated metal electrode, a metal-electrode holder and two sources of current. One source is a-c, and this is used to supply the twin-carbon torch because it results in an even burn-off of the carbons. The other source, which may be either a-c or d-c, is used for supplying the metal electrode.

In operation, the twin carbon torch is held in the right hand so that the carbons are at an angle of 30 deg to the vertical and moved along the joint from right to left. The joint to be welded is kept midway between the two carbons, which are held about ⅛ in. above the work.

A certain degree of "arc heat" control is obtained by adjustment of the "arc gap." The operator makes such necessary adjustments while welding as conditions demand. The arc is started by depressing a thumb lever, which causes the two carbons to contact each other, thus producing an arc. By releasing the pressure slightly, the proper arc gap is easily adjusted.

The twin-carbon arc is moved to within ⅛ in. of the point where welding is to begin. A circular motion of the arc is momentarily employed for about 5 seconds in order to preheat the work at the starting point. At this time auxiliary arcing takes place between one of the carbons and the work.

The next operation is the introduction of the metal electrode. It is held in the left hand and placed directly over the seam to be welded, contacting the surface of the work at the starting point. The twin carbons and the metal rod are kept approximately 3/16 in. apart. Arcing now takes place between the metal electrode and the carbons, from one carbon to the other, from the metal electrode to the work and from one carbon to the work. All of this produces five individual arcs functioning as one. The arc action causes immediate fusion of the metallic deposit with the parent metal, producing a weld having uniform penetration and freedom from porosity.

The current supply for any individual circuit is not sufficient to produce welding by itself. A constant, smooth arc is maintained from the metal electrode to the carbons and the ground because of the ionization produced by the carbon arc. As a result, control of the heat is such that it has been possible to weld 0.016 in. 24S-T Alclad aluminum alloy by this process without a back-up strip. Reverse polarity is preferred for welding aluminum, but straight polarity may be used.

The importance of the multiarc process is that it permits the delivery of large amounts of heat, capable of being delivered in concentrated form and under perfect control to the surface of the material being welded. The heat transfer and temperature are of a nature which permits the parent metal to receive preheat and the weld deposit to acquire postheat. All gases and impurities are thus allowed to escape to the surface of the molten metal before it becomes plastic enough to entrap them and cause porosity. The appearance of the weld surface is sometimes affected by this action, causing roughness. Metallographic and X-ray studies show the roughness to be a surface condition only.

» «

Heavy Cutting Fundamentals

By H. G. Hughey *and* G. L. Walker
Air Reduction Sales Co.

This paper listed typical records of cutting steel 12 in. thick and over. Some of the necessary information required for fundamental consideration was mentioned. Particular emphasis was placed upon adequate knowledge of capacity and general characteristics of the torches and tips. Considerable data covering 12 to 36 in. material were presented. These data embody variations of tip sizes, oxygen flows, oxygen pressures and cutting speeds.

A discussion and analysis of the data suggests the existence of certain common relationships from which it is possible to establish a better understanding of the effect of various factors. For a given thickness, it is shown that within rather wide limits the oxygen flow remains the same to produce a comparable result. Likewise, it is shown that within these limits the speed varies but slightly. A broad comparison of data discloses that common practice for heavy cutting has often been limited to borderline conditions wherein slight differences in speed, flow or pressure seriously affect the results.

A frequent source of erratic results lies in the extreme pressure losses existing in the system between the regulator and tip. By measuring pressures at the torch entry, conditions beyond this point remain fixed, and it becomes possible to obtain repetitive and comparative results. All thicknesses were found to be satisfactorily cut at pressures between 25 and 50 psi, measured at the torch. Pressures above 50 psi produced increasingly greater cutting stream expansion with less control of operations.

It was found that the oxygen flow requirements in cu ft per hour could be listed in terms of thickness in inches (T) wherein the best results ranged from 80T to 125T with an intermediate value of 100T suitable for initial settings. Flows above this could be used, but with decreasing control and economy.

Of the other factors, the degree of preheat was found to be very important. Too little preheat (due largely to equipment limitations) has commonly prevailed. The starting of the cut calls for an adequate preheat before turning on the cutting jet and for heating well down the starting face. The actual execution of the cut will require only normal procedure if the factors are in balance.

The operating recommendations included tip orifice sizes, flows and pressures. All pressure measurements were designated as torch entry pressures. The speeds were within a narrow range with about 3 in. min. as a satisfactory starting condition, ranging to as high as 5 in. min. for 12 in. material.

» «

Fabrication and Reclamation in Steel Mill Maintenance

By E. W. Gruber
Plant Engineer, Wheeling Steel Corp.

This paper discussed the work of the welding department at the Yorkville plant of the Wheeling Steel Corp. and illustrated some of the more outstanding examples as well as minor, more routine examples of its plant maintenance and construction work. These jobs are classified under the headings of replacement fabrication, original fabrication, reclamation and repair, and plant maintenance.

Among the welding jobs discussed were the fabrication of internal combustion units, of copper conductor rolls, of complete equipment for oil reclamation and of caustic cleaning tanks. Reclamation jobs discussed were the operation of flame-hardening of mill rolls, the restoration of worn bronze mill guides, the lead burning and integration of lead castings in repairing or replacing lead parts on pickler tanks and repairs to burned-out tin pots. Plant maintenance welding jobs described included pipeline welding, fabrication of pipe fittings, a special technique for welding crane rails into continuous lengths and a variety of miscellaneous smaller maintenance welding jobs.

One of the most pertinent conclusions drawn from this selection of subjects was that it is both practical and necessary for a steel mill to be potentially almost entirely self-dependent as far as the maintenance mill operation is concerned.

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Welding-Arc Characteristics in Helium and Argon Atmospheres

By F. A. WASSELL

Welding Engineering Div., General Electric Co.

RECENT investigations of the inert-gas-shielded arc welding of aluminum have resulted in the discovery of several methods by which aluminum can be welded without the use of flux. These methods are based on the use of argon and helium as atmospheres with either a-c or d-c welders. The following observations were made in an investigation of these methods in the General Electric welding laboratories.

The success or failure of aluminum arc welding without a flux depends primarily upon the proper dispersion of the surface oxide film by the arc. This oxide appears to be dispersed by the d-c, electrode positive (reverse polarity) arcs in argon and helium and under certain conditions by the a-c arc in the same gases.

In d-c welding in argon, a bright, mirrorlike molten pool and weld bead were formed, and fusion of the two parts to be joined was very easily accomplished when the electrode polarity was positive. When the electrode polarity was negative, the oxide film was not dispersed and welding was not accomplished. In the latter case, the resulting weld bead had a wide zone of melting with a black, narrow arc track down the center. Fusion of two plates, butted tightly together, was not accomplished by this arc without the use of flux.

In a-c welding of aluminum, rectification of the current occurred at all times to a greater or lesser degree depending on the welding circuit constants. When little or no rectification occurred, the oxide film was not dispersed and welding (without flux) could not be accomplished. Rectification was complete in the argon arc if the open-circuit voltage was below a critical value of somewhere between 140 and 180 volts. The critical voltage for the a-c helium arc was apparently somewhere about 280 volts.

Good welding in the helium a-c arc resulted in a weld having an appearance very similar to that of the d-c, electrode positive weld in helium. Both welds exhibited the same characteristic wide weld bead with a dark brown deposit on the surface. The most significant characteristic of the a-c helium welds was the absence of violent agitation in the weld pool and porous ridges in the solidified metal, both of which were frequently observed in d-c welds.

Of all the materials tried as electrodes, tungsten proved to be the most desirable for the inert-gas-shielded arc welding of aluminum. Tantalum, molybdenum, steel, copper, aluminum and carbon were found to be less desirable because of their lower melting points and higher consumptions.

Arc voltage varied directly with arc length in both a-c and d-c argon and helium arcs. The arc voltage versus arc length curves of the helium arcs have a greater slope than those of the argon arcs.

The appearance of the d-c welds in argon became increasingly worse above 100 mils of arc length, while the a-c welds in the same gas did not begin to lose their good appearance until 200 mils of arc length were reached. Below 20 mils, an arc could not be maintained because the metal rose and fused to the electrode.

The rate of gas flow has a definite effect on the arc voltage and the appearance of the argon welds, particularly the d-c welds. At gas flows below 6 cfh, the a-c and d-c arc voltages were high, and the appearance of the welds very poor. At 6 cfh of gas flow the arc voltages were at a minimum, and the appearance of the welds was good. Above 6 cfh, the d-c arc voltage increased with the gas flow while the a-c arc voltage remained at substantially the same value. The d-c arc became unstable and the weld appearance poor at gas flows above 14 cfh, while the a-c welds retained their good appearance up to 20 cfh of gas flow.

» «

Spot Welders for Heavy-Gauge Metals

By MARIO SCIAKY

Sciaky Brothers

SECTION one of this paper showed how the thickness of material affects the design of the spot-welding machine. Both ferrous and non-ferrous materials were discussed. For ferrous materials the factors to be considered are: rusty and scaly surfaces, the necessity for long welding times, power demand, the effect of steel between the arms, the need of special features such as preheat, postheat, forging, etc. for special steels, the necessity for special cooling in secondary circuits, electrode contour and pressure requirements.

Under non-ferrous materials must be considered the need for long discharge time, the shape of the discharge curve, the difficulties involved when using the stored-energy method of welding, the necessity for forging and preheating, the shape of electrode tips, etc.

The second section told how spot welders are constructed for heavy-gauge metals, while the third section discussed the characteristics of heavy-gauge welds in both ferrous and non-ferrous metals.

In conclusion, Mr. Sciaky stated that machines designed for welding such materials now exist and operate satisfactorily, particularly for heavy gauges of steel. Spot welders for heavy gauges of aluminum, he thought, seem to be too large in comparison with the volume of work accomplished. Only the new applications of the near post-war future will determine on a large scale whether or not the spot welding of heavy-gauge materials is practicable.

» «

Welding Aluminum Tank Cars

By A. H. WOOLLEN

Chief Engineer, Railroad Div., Aluminum Co. of America

THE first aluminum alloy tank was put in service in August, 1928. This was a welded tank built of Alcoa 3S1/2H plate. Bottom plates were 5/8 in. thick, shell plates 1/2 in. thick. Due to limitations of manufacturing, 16 plates were used for this car as compared to three in the same capacity car at present. Oxy-acetylene welding was used, and the plates were carefully preheated prior to welding. This tank was built by General American Transportation Corp. in its Sharon, Pa., plant. After fifteen years of service the car is in excellent condition today.

The performance of the first car caused the tank car committee of the Association of American Railroads to establish a definite classification for non-regulatory cars, Class AAR 201 A35W, and official specifications were prepared and included in the Manual of Recommended Practice. Approximately 100 of these welded tanks were built during the succeeding ten years.

In 1936 a modification of the original design was tried, using plates of Alcoa 61SW alloy and employing metal-arc welding for the seams. Alcoa No. 27 flux-coated electrodes were used. These changes reduced the weight of the car and increased its strength.

In order to have a comparison between the 3S car and the 61S car and the two methods of welding, a series of drop tests were conducted. The fact developed that while the 61S car was definitely stronger, failure did occur and it occurred in the weld whereas failure in the 3S car occurred by deformation of the plates, the weld remaining intact.

Definite progress in welding methods has been accomplished. One manufacturer, American Car and Foundry Co., uses the electronic tornado automatic system employing a wire electrode. The development of the art of welding during the war years indicates a possibility of still further improving the technique of welding tank cars and obtaining greater efficiency in welded tank car joints.

» «

Inspection and Salvage of Machinery Weldments

By JAMES W. OWENS

Director of Welding, Fairbanks, Morse & Co.

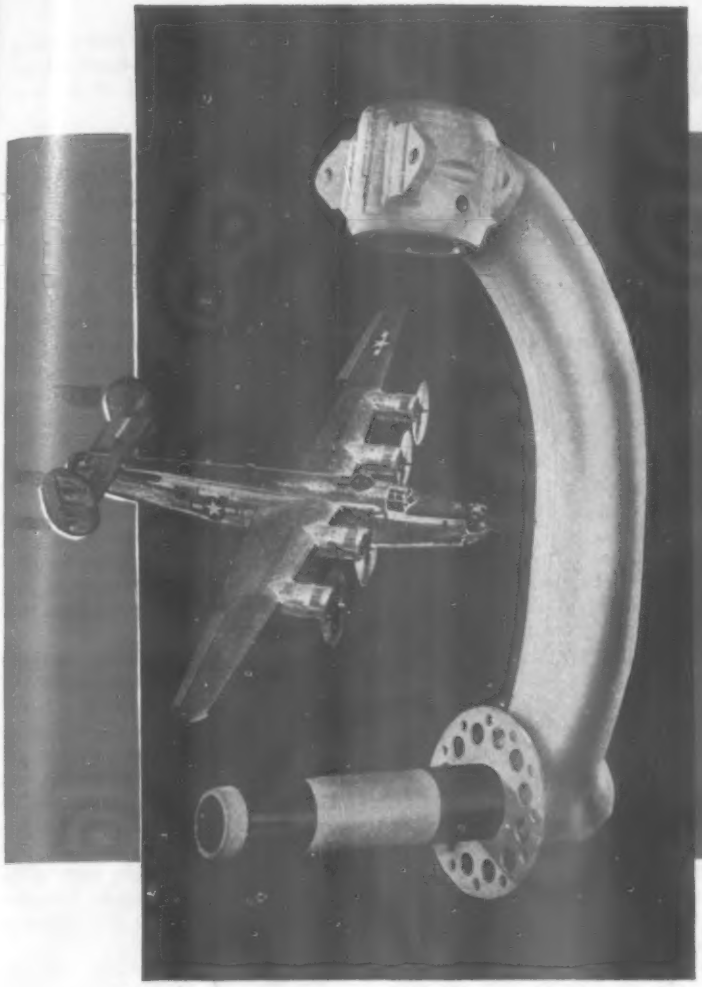
THIS PAPER dealt with the inspection and salvage of "customer inspected" and "non-customer inspected" weldments in a large organization having shops for the machining of weldments fabricated in both its own welderies and by its subcontractors.

In addition to the routine phases of inspection and salvage, the author presented fundamental information from two researches on:

(*a*) The effectiveness and utility of d-c vs. a-c magnetic-particle inspection and—

(*b*) The precision welding of plain-carbon steels.

The author outlined the procedures used in the inspection of templates, dies, fixtures and the various processing operations, and illustrated the relative effectiveness and utility of d-c and a-c magnetic inspection by contrasting the patterns obtained or not obtained with both d-c and a-c. He concluded that alternating current should, in general, be used for the inspection of fillet welds, butt welds designed for partial penetration and the inspection of plate edges for laminations. Direct current should, in general, be used for the inspection of butt welds designed for 100% penetration and a relative freedom from porosity. It was the author's considered opinion that magnetic inspection can be more effectively utilized by the individual and combined use of d-c and a-c instead of the present almost exclusive use of d-c equipment.



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Chemical Cleaning Methods for Aluminum Alloys

By F. M. MORRIS
Fleetwings Div., Kaiser Cargo, Inc.

THIS paper summarizes the results of a survey on the chemical cleaning of aluminum alloys for spot welding. The survey was conducted by forwarding a questionnaire to about 50 aircraft companies throughout the United States. Thirty companies returned the completed questionnaire, and replies were received from others stating that chemical cleaning methods were not being used. A summary of the answers to the questionnaire is given below:

(*a*) *Precleaning heavily soiled parts:* Vapor degreasers are generally used for degreasing heavily soiled parts such as drop hammer parts, mechanical die formed parts and stretch formed parts where lubrication is used. Trichlorethylene (under various trade names) is chiefly used.

(*b*) *Precleaners for lightly soiled parts:* Precleaners of the alkaline type, compounded and buffered to prevent attack of aluminum alloys for fairly long periods of immersion, are used for cleaning lightly soiled parts with dust, light oil films, etc. The primary function of the precleaners is to prepare a chemically clean surface so that the oxide remover in a subsequent operation may produce a surface of low, uniform resistance suitable for spot welding.

(*c*) *Chemical oxide remover:* Nine acidic types of oxide remover are used on Alclad while two alkaline types of oxide remover are used on bare 24ST to reduce the surface resistance for spot welding.

(*d*) *Oxide remover solution strength control:* The solution strength is controlled by titration, with a few companies using pH control. Contact resistance measurements are not normally used for controlling solution strength.

(*e*) *Dipping procedures:* The time of immersion in the precleaner for lightly soiled parts varies from 1 to 20 minutes, depending on the soil to be removed. Cold, warm and hot water rinses are used after precleaning. Nineteen of the companies reported difficulty in removing identification ink markings; scrubbing with brushes is necessary, which slows up the cleaning process. Generally, no trouble was experienced with oil removal. The majority of companies clean parts in oxide remover in detail, and do not wipe parts after the final running water rinse but dry them with an air blast.

Most companies have two different time periods of immersion in the oxide remover. The short period is used on thin material and the longer period on thick material. All companies using hydrofluoric acid generally have different time periods for each thickness.

The time of spot welding after oxide removal varies from a few minutes up to 72 hours, but with most companies spot welding is done within ten hours.

(*f*) *Production spot-welding results:* Replies were very limited on the average number of spot welds between electrode tip cleanings and varied considerably (50 to 300 spots for 0.020 to 0.020 in., 20 to 200 spots for 0.040 to 0.040 in.) when using the same type of oxide remover and spot welder on the same thickness of material. Due to the many variables involved, surface resistance of sheet, electrode shape, temperature of tip coolant, speed of machine, time delay after oxide removal before spot welding, weld shear strength, etc., it is not possible to explain the difference in the number of spot welds which were obtained between tip cleaning when using the same oxide remover.

» «

Welded Building Construction

By H. W. LAWSON
Bethlehem Steel Company

THE PART which welding has played in war production has created an interest in welded construction which is likely to be reflected in increased demand for welded building construction after the war. If the steel industry and the structural engineer are to be prepared to meet this demand, some standardization in the details of some of the commoner connections is necessary as well as some agreement as to design methods for many others.

This paper was presented for two purposes:

1. To show there is now an adequate basis in research (particularly in that conducted over the last fifteen years at Lehigh University) to justify an agreement on the principles of design for beams and their welded connections;

2. To offer for the case of greatest first interest; viz., the typical case of simply supported beams, a set of welded details which, with their capacities, are ready for handbook publication and general professional acceptance.

Before developing design formulas, attention was called to certain clauses in the American Institute of Steel Construction Specifications for Welded Buildings. Here three types of construction are set up: Type 1 or rigid frame assumes connections sufficiently rigid to hold the original angles between the various members virtually unchanged. Type 2, conventional or simple framing, assumes the member connected for shear only and the joints free to rotate under load. Type 3, semirigid, assumes the joints to possess dependable and known moment capacity intermediate between Types 1 and 2 construction. The Lehigh University researchers recommend for these three types joints that should develop respectively not less than 90% rigidity, not over 20% rigidity, and from 20% to 90% rigidity.

After a resumé of the research, the paper proposed design methods for framing connections, seat angles, stiffened seats or brackets, and top plates to be used with seats in flexible, semirigid or rigid framing. Comparisons were made with similar design methods used by Gilbert Fish, Malcolm Priest, Bruce Johnston and others.

A plea was made to discard certain holdovers from riveted thinking, since these act to restrict the range of application of certain welded details. Particularly is it necessary to be sure that apparently analogous riveted-welded conditions are really similar.

Standard top-angles, framing angles, flexible and stiffened seats, were proposed, together with their capacities, piece marks, and symbols for graphic representation. A sample page from a steel handbook indicated the method of selection of the proper detail.

» «

Relief of Residual Stresses in Low-Alloy Steels

By LT. COL. PAUL C. CUNNICK *and* J. K. MCDOWELL
Ordnance Dept., Rock Island Arsenal

THE purpose of this investigation was to obtain information on the effect of time and temperature on the relief of residual stresses in high-tensile, low-alloy structural steels. Suitable stress-relief heat treatments for plain carbon steels have been developed, largely empirically, though supported in part by some experimental data. No such background, however, exists for low-alloy steels, and some trouble has been encountered in stress relieving Ordnance structures of low-alloy steels to meet the required degree of dimensional stability.

The method used by the authors to determine the effect of various stress-relief heat treatments consisted of stressing a specimen in a fixture to a value slightly above the yield point, subjecting the specimen and fixture to the desired heat treatment, and after cooling to room temperature measuring the relaxation which took place in the specimen when the load was released. The stressing fixture and specimens were of the same material so that expansion characteristics would be the same and thus eliminate any additional stresses.

An electrical strain gauge and indicator were used to measure the relaxation after stress-relief heat treatment.

The steels used in this investigation were SAE 4130, NE 8630, a copper-nickel-phosphorus steel in the 70,000 psi yield-strength class and two high-tensile, low-alloy steels in the 50,000 psi yield-strength class; namely, carbon-manganese and manganese-silicon-chrome. For all five steels, the effect of stress-relief heat treatments of one, four and eight hours at 900 F, 1,000 F, 1,100 F and 1,200 F was determined.

Graphs on which the values of residual stress and percentage of stress relief were plotted against stress-relief temperatures show that no two of the steels react exactly alike to the various heat treatments. However, the general shapes of the curves for carbon-manganese and manganese-silicon-chrome steels were similar as were those for SAE 4130 and NE 8630.

From the results of this investigation, it was concluded that:

(*a*) The degree of stress relief obtained is affected more by temperature than time at temperature.

(*b*) Different steels, stressed beyond their yield point, do not react alike to heat treatment with regard to the degree in which residual stresses are lowered.

(*c*) The increase in percentage of stress relief is not uniform as temperature or time at temperature are increased.

(*d*) With few exceptions, the increase in percentage of stress relief is greatest as the temperature is raised from 900 to 1,000 F.

(*e*) The effect of time at temperature is more pronounced at the lower stress-relieving temperatures.

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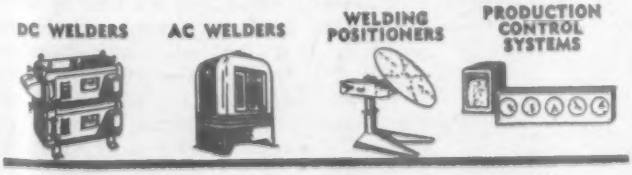

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Biaxial Fatigue Strength of Low-Carbon Steels

By G. K. MORIKAWA *and* L. V. GRIFFIS
Illinois Institute of Technology

THE need for greater fundamental knowledge of the behavior of metals under multiaxial stress conditions imposed by various types of loading—static, creep, fatigue, and impact—has become quite apparent at the present time. Concerning the fatigue properties of metals under combined stresses, very little information is available; with regard to the strength of welded metals under combined cyclic stresses, no information has yet been advanced.

The purpose of this investigation was to obtain basic information on the fatigue strength of metals (both unwelded and welded) subjected to cyclic combined stresses. Due to the nature and design of the combined internal pressure-axial tension type of fatigue machine, the investigation, so far, has been restricted to biaxial stresses, synchronized in phase, with both stresses tensile.

Silicon-killed, SAE 1020 steel was investigated, using thin-walled tubular specimens of 1 in. internal diameter, 0.050 in. wall thickness and 1½ in. length of uniform section. The tests were limited to a maximum of about 3 million cycles.

For annealed, unwelded SAE 1020 steel, endurance limit tests were made for six different stress ratios with stresses fluctuating in phase between zero and maximum for each ratio. The results indicate a possible effect of the intermediate principal stress upon the fatigue strength of this material. However, the effect of two additional variables must be considered in the interpretation of results.

» «

Welding in Shipbuilding

By M. N. MALTSEFF
Western Pipe and Steel Co.

LACK of experienced welding designers and supervisory personnel greatly affected construction in early stages of the shipbuilding program. Oldtime shipbuilders were still influenced by riveted design of the hull and in general were skeptical about the new construction methods. Gradually, however, the old ideas began to change and to fall in line with the demands of the new, modern type of construction.

Steel industries met this emergency period unprepared to furnish all the desirable structural shapes needed by naval architects for the welded type of construction. The development of automatic welding, flame-cutting and welding electrodes progressed fast and contributed much to the construction of sound, economical modern welded ships. Methods of depositing weld metal, sizes of welds, types of connections, methods of erection and numerous other items were revised from time to time, and all revisions have contributed to the better and more economical type of welded ship.

It is apparent that in the future various changes will become effective in the design of hull structure. The shelter deck, as one of the major strength sections of the ship, no doubt will have an entirely different appearance. Instead of large square hatches that abruptly change cross-sections of the deck plating there will be an oval (or some other shape of opening) which will provide a streamlined path for the stresses to flow easily and without obstruction through reduced areas of deck.

It is reasonable to believe that the gunwale will be eliminated since in its present form it is just as detrimental to the hull structure as an excessive buckle in the bottom shell or continuously welded bilge keel. Sea-chests and other openings in the shell of the hull will be of round or oval shape in order to prevent the concentration of stresses at the openings.

» «

Production Control System

By E. C. BREKELBAUM
Welding Supt., Harnischfeger Corp.

THIS paper covered the problems arising in production welding and production control. The production control system of the author's company was compared to other methods of wage incentive and cost control systems, and the advantages and disadvantages were compared and discussed.

A detailed discussion of the functioning of the production control system relative to control of costs, procedure control, production control and quality control followed. Methods of establishing arc time by actual time study and by theoretical methods were then taken up, and tables and charts for theoretical figuring of arc time and welding rates were given. A discussion of the application of the production control system to all types of welding work completed the paper.

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Data on the Welding of Manganese High-Tensile Steels

By W. B. Brooks *and* A. G. Waggoner

Cramp Shipbuilding Co.

THIS study was based on the all-weather welding of plates ¾ in. or heavier, and the comments and data are not necessarily applicable to lighter plates or more favorable welding conditions. Thirteen commercial manganese steels containing 0.14 to 0.20% C, 1.0 to 1.5% Mn, with additions of V or Ti, were studied. They were observed to have a pronounced tendency to cracking under normal welding conditions.

These steels were found to have a highly variable hardenability as determined by the L-Jominy test. Their hardenability and heat-affected-zone hardness were comparable to those of steels which are customarily preheated and stress relieved. Their hardenability was substantially less than would be predicted by the Grossmann method. Probably this is because they have a much more complicated system of decomposition reactions than those steels upon which most hardenability studies have been based.

The ductility of the heat-affected zone as measured by the slow-notch-bend test was observed to decrease very rapidly with hardness above 300 Knoop. Correlation between maximum hardness of the heat-affected zone and the slow-notch-bend angle was good and did not appear to be affected significantly by special alloying elements or types of steels. Most of the steels studied had slow-notch-bend angles of less than 15 deg, which is considered to be the satisfactory minimum for this test.

Based on a graphic comparison of Grossmann hardenability factors and Walters strength factors, it seemed possible to make a high-tensile steel of low hardenability. One ten ton heat was made on this basis. Its Jominy and weld-hardenabilities were low. Its tensile properties were satisfactory. Its notch toughness was excellent down to —60 F. Its slow-notch-bend angles were poor, and its sensitivity to strain aging embrittlement was comparable to that of medium carbon steel. The heat-affected zone showed a tendency toward Widmanstatten characteristics.

» «

Oxy-acetylene Pressure Welding

By A. R. Lytle

Union Carbide & Carbon Research Labs., Inc.

THIS paper described the technical and mechanical aspects of a welding method known as oxy-acetylene pressure welding. This process may be fully or partially mechanized. The pieces to be joined are butted together under nominal pressure, then heated by means of multiple small oxy-acetylene flames to a temperature of about 1,200 C and finally upset to a controlled degree. The process possesses many special advantages, among which are: adaptability to high-carbon and alloy steels (welded with difficulty by fusion-welding methods), excellent physical properties, smoothness, etc. The process is being widely used to weld railroad rails, overland pipes from 2 to 24 in. in diameter, oil-well tool joints, small liquefied gas tanks, boiler tubes and for many other commercial welding operations.

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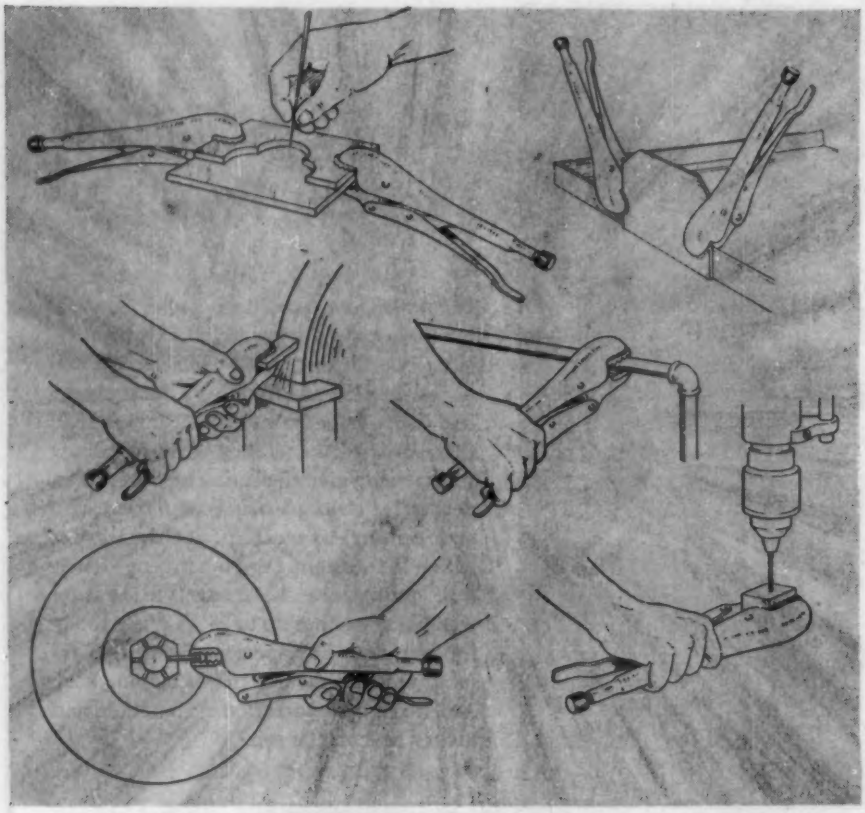

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Geometry of the Ideal Spot-Welding Tip

By E. D. CRAWFORD *and* C. W. STEWARD
Curtiss-Wright Corp.

ONE of the major problems in the spot welding of aluminum alloys by present methods is that of preventing rapid tip pick-up. If the tip life could be appreciably increased, the immediate benefits would be a noticeable reduction in production costs and a more uniform quality of spot welds.

In the welding of aluminum parts, the tip contour is equally as important as the method of surface preparation.

Many types of contour have been tried. Most of them yielded equally poor results, but a slightly raised flat button was found to produce remarkably good tip life. When used on condenser discharge spot welders (which are free from tip skidding), several thousand high-strength spots can be obtained per tip cleaning.

This raised button can be formed in the spot welder by pounding domed tips together with a high tip pressure and normal current for approximately 100 cycles of the machine. This procedure, unfortunately, will not produce a perfectly symmetrical contour every time. It is therefore necessary to use a tool that will give the same height and diameter of button consistently. Two types of tools have been designed for this purpose. The most effective is essentially a segment of the cutting edge of a lathe tool, which is fastened to a disc fitting into the holder that acts as a guide for the tip. If preferred, the tips may be shaped directly in a machine lathe with an accurately ground form tool. In operation, the hand tool can be rotated between the tips mounted in the spot welder. More satisfactory results, however, are obtained when the tip is rotated in a drill press and the tool held stationary.

Since the diameter of the button varies with the thickness of the material being welded, it is necessary to have three tool sizes to cover the thickness range from 0.020 to 0.081 in.

When the spot strength is maintained at 550 lb, domed tips of 3 in. radius produce an average of 56 spots per tip cleaning on two sheets of 0.040 in., chemically cleaned 24S-T Alclad. The hand-tooled preshaped tips will give an average of 1,564 spots under the same conditions, even higher results on thinner material.

Portable Condenser Welder

By E. M. CALLENDER
Edward G. Budd Mfg. Co.

A NEW application for the condenser-discharge welder in welding stainless steel was given in this paper. A lightweight portable repair welder suitable for field use was described, together with such novel features as the use of a portable air-gun tool, light flexible tool cables and a small compact welding transformer.

Some discharge welder fundamentals were covered with special reference to the influence of the welding transformer. The appendices covered various mathematical discharge equations.

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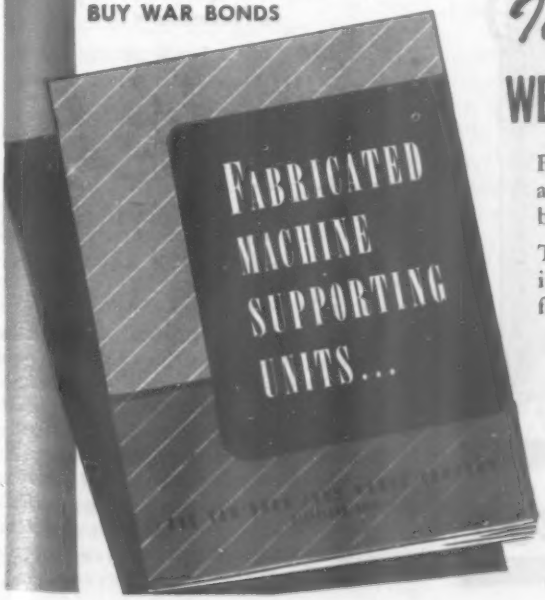

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Development of Modern Heavy-Coated Electrodes

By D. C. SMITH *and* W. G. RINEHART
Harnischfeger Corp.

IMPROVEMENTS in modern heavy-coated electrodes during the past few years have been brought about by the development of new coatings and coating materials. The commercial availability of potassium compounds has resulted in the new high-quality all-position a-c/d-c electrodes needed and demanded by the welding industry because of the increased use of a-c equipment. These new a-c/d-c electrodes, in addition to their a-c operating characteristics, produce weld metal equal to or better than the older d-c electrodes in the same class and application and can be substituted for such electrodes.

A new approach to the development of electrode coatings was suggested. By studying the influence of various coating materials on the arc energy distribution between cathode and anode a means might be found for evaluating the influence of possible coating materials on their arc behavior. An equal distribution of energy between cathode and anode is desirable for a-c arc welding.

The coatings, properties and applications of the three fundamental groups classified by the AWS-ASTM as the E-60XX series were discussed with particular emphasis on E-6011 and E-6013 all-position a-c/d-c electrodes. The authors gave the desired properties of a typical all-position electrode and told how they may be obtained by the use of various coating materials. The distinguishing profile and differences of penetration of the six classes of electrodes were illustrated by photomacrographs.

The paper also discussed the development of a new unclassified ferritic electrode for the welding of alloy steels without causing cracks under the bead or in the base metal.

» «

Flash-Butt Welding of Alloy Steels

By J. J. RILEY
Taylor Winfield Corp.

THE fundamentals of the flash-butt welding process do not change with changes in the chemical composition of steels. The use of alloy steels has demanded a more closely controlled welding technique. High-joint efficiencies can only result from high-quality welds in parts heat-treated to high-tensile strengths. The rapid air-hardening characteristics of certain steels can be checked by postheating in the welder.

The heating period of the weld, designated as the flashing action, is one of the principal actions to be controlled. The second principal action is the upsetting action—the period in which the weld is actually made. The welding variables forming part of the upset action are the upset pressure, upset velocity, upset time, and upset current time.

The correlation of dimensional variables was presented in tabular form. This working chart was formed from a compilation of dimensional variables obtained from a number of fabricators using the flash-butt welding process as well as from the author's personal experience.

Postheating was discussed very briefly as was the practice of releasing the clamping pressure automatically during the cooling period of the weld.

In conclusion, the author recommended automatically controlled welding equipment.

» «

How Much Ductility Is Necessary?

By W. J. CONLEY
The Lincoln Electric Co.

THIS paper began by explaining the action of metal during elongation. It was pointed out that there is a difference between elongation as measured by the tensile test and the true value. Conditions which may change action of metals so that they are not able to show normal elongation or yield and means for avoiding this condition by correct design were explained.

The fact that a metal has a large value of elongation does not insure that it will have a relatively equivalent performance with regard to other characteristics such as impact resistance, endurance and notch endurance resistance or creep resistance. The author contended that for all practical purposes only a very small elongation was necessary to allow for the required plastic yielding for adjustment to stress concentration and non-uniform conditions.

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A B C's of Galvanic Corrosion*

If two unlike metals are connected to one another in a corrosive liquid such as brine, one metal is often corroded at a much faster rate than usual, while the other metal either remains clean or is corroded at a much slower rate than usual. This type of corrosion is always associated with the generation of electrical current and hence is described as galvanic corrosion. It is the galvanic action which speeds up corrosion beyond the ordinary rate. The metal corroded by the galvanic effect is said to be anodic; the more or less protected metal is termed cathodic. Corrosion engineers also speak of the cathode as the "more noble" metal and the anode as the "less noble" metal—using the word "noble" in a broader sense than its original meaning in the case of precious metals such as gold and platinum.

Galvanic Series

Experiments have been conducted to arrange metals in a galvanic series. Such a series shows the tendency of metals and alloys to form significant galvanic cells and indicates probable direction of the galvanic effects. Within the galvanic series, the metals and alloys may be divided into groups. The members of a group have no strong tendency to produce galvanic corrosion with each other and so are relatively safe to use in contact with each other unless the area of the less noble metal is markedly smaller than that of the other. The coupling of two metals distant from each other in the series will frequently result in galvanic or accelerated corrosion of the less noble metal. The farther apart the metals stand, the greater will be the galvanic tendency.

The galvanic series given in the middle column is based upon a series of experiments on and practical experience with many common corrosives. It should not be used without additional experimental tests when unusual corrosives are encountered or other unusual conditions prevail.

Anode and Cathode Effect

The relative areas of two metals forming a galvanic couple will have a very important bearing on the extent of the corrosion. Under many conditions the corrosion loss due to galvanic action is very nearly directly proportional to the area of the more noble metal. Thus if a piece of steel is coupled to a piece of copper having a surface area of 100 sq in., the corrosion loss of the steel is increased by an amount which is roughly 50 times what it would be if the same piece of steel were coupled to a piece of copper having an area of 2 sq in. For this reason it is wise to avoid galvanic couples in which the exposed area of the lower (more noble) metal in a galvanic series is much greater than that of the higher or less noble metal. As a practical example, it would be definitely dangerous to use steel welding on a Monel plate but relatively safe to use Monel welding on steel.

Other Influencing Factors

The intensity and distribution of galvanic corrosion is influenced by many factors in addition to those cited above. One of the most important of these is the conductivity of the complete circuit. Since the voltages developed are very low, any practice that will increase the resistance or interrupt the circuit will minimize if not eliminate galvanic action. The partial or complete insulation of the metals at their points of contact or connection is very effective. The hydrogen which collects on the surface of the lesser attacked metal during corrosion acts in effect as an insulator and thus tends to suppress corrosive action on the more attacked surface.

Galvanic action can also be retarded by reducing the amount of dissolved oxygen. Oxygen tends to combine with the newly formed hydrogen and remove it as water. Since the removal of the hydrogen film allows corrosive action to continue, the presence of oxygen should be minimized.

Recommended Practices

(1) Use combinations of metals as close together in the galvanic series as possible.

(2) Keep dissimilar metals as far apart as possible. This rule applies even when the actual connection between the metals is external to the corrosive liquid.

(3) Avoid threaded connections for joining metals well apart in the series. Instead employ brazed joints, using a brazing alloy that is more noble than at least one of the metals to be joined.

(4) Avoid combinations in which the area of the less noble metal is relatively small.

(5) Insulate dissimiliar metals wherever practicable. If complete insulation cannot be achieved, a paint or plastic coating at the joints will increase the resistance in the circuit and so help to reduce corrosion.

(6) Apply coatings with caution. When painting, for example, do not paint the less noble metal without also coating the more noble. Otherwise a greatly accelerated attack may be concentrated at imperfections on the coating of the less noble metal. Coatings, needless to say, should always be kept in good repair.

(7) If practicable, add chemical inhibitors to corrosive solutions.

(8) Install pieces of bare zinc or steel to provide a counteracting galvanic effect tending to suppress unwanted galvanic corrosion.

Galvanic Series

Corroded End (anodic or least noble)

Magnesium
Magnesium alloys

Zinc

Aluminum 2 S

Cadmium

Aluminum 17 ST

Steel or iron
Cast iron

Chromium-iron (active)

Ni-Resist

18-8 Stainless (active)
18-8-3 Stainless (active)

Lead-tin solders
Lead
Tin

Nickel (active)
Inconel (active)

Brasses
Copper
Bronzes
Copper-nickel alloys
Monel

Silver solder

Nickel (passive)
Inconel (passive)

Chromium-iron (passive)
18-8 Stainless (passive)
18-8-3 Stainless (passive)

Silver
Graphite
Gold
Platinum

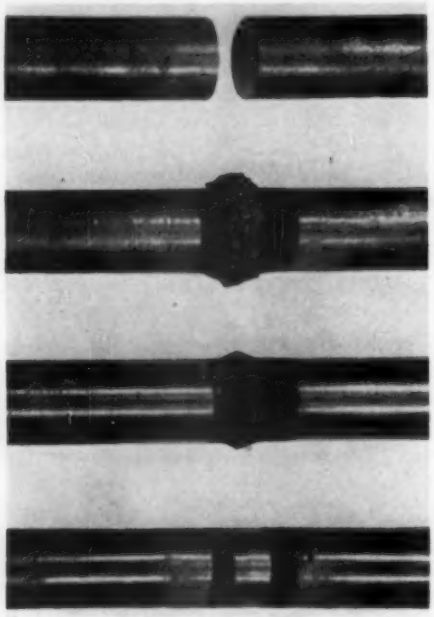
Protected End (cathodic or most noble)

*Data courtesy Development and Research Division, International Nickel Co., Inc.

On the Job

Portrait of a Flash Weld

THE accompanying picture shows four steps in the end-to-end flash welding of a cold-rolled steel rod. At the top are the two ends before they have been brought together. The next two pictures show,



Top to bottom: two rods before flash welding; flash resulting from the weld; the flash removed; the final machined surface.

respectively, the flash (extrusion) resulting from the weld and the jointed rods after removal of the flash. Completing this portrait of a flash weld, the bottom picture shows the rods machined to the desired size. The weld joint is almost impossible to detect.

Flash welding can also be applied to tubular sections and to the edge-to-edge welding of plates. The materials to be joined are clamped into an electrical circuit by clamps which are required to be not only good conductors of electricity but strong enough to hold the material at twice the pressure needed for the push-up. As the metals approach each other, a flashing occurs; this burns off any irregularities and reduces the ends (or edges) to a plastic state. The final rapid upset, timed to a split second, forges the abutting surfaces together under high pressure to complete the weld.

Although applicable to areas as small as 6.0015 sq in., flash welding particularly lends itself to the welding of large cross-sections of material without prohibitive peak power demands. According to the Resistance Welder Manufacturers Association, Philadelphia, the process has been used successfully to join pipe sections having a one inch wall thickness and ranging up to 40 ft in length.

» «

Battlefield Repairs

A TRAVELING welding shop installed in the back end of a 2½ ton truck is saving valuable time on Army construction jobs in the European theater of operations. Its soldier-weldors provide expert repair service for Diesel shovels, ditch-diggers, Caterpillar tractors, carry-alls, bulldozers, graders, dump trucks and other heavy machinery. One of their specialties is "dental work" on the worn or broken teeth of shovel buckets and ditch-digger scoops.

Formerly, disabled equipment had to be loaded onto a trailer and hauled by a wrecker to a base shop, which might be anywhere from 50 to 100 miles away. Then Lt. Clyde Fritz of Gypsum, Colo., had an idea. He swapped, borrowed and promoted until his collection of welding equipment was complete and called in a couple of skilled weldors, Sgt. Frank Houhse of Ventura, Calif., and Corp. Bill Haynes of Tulsa, Okla., to assemble the mobile shop. They did the job in less than a week.

Under the truck's tarpaulin is a welding plant as compact as the kitchenette of a one-room apartment. The equipment includes an arc welder, an acetylene generator, a drill press, a grinder, welding tables and steel work benches full of assorted tools. Shuttling between camp, airdrome, depot and other types of construction projects, the shop does everything from helping to make an ice cream freezer to rebuilding a tractor sprocket.

Courtesy, The Hobart Brothers Co.

Lt. Clyde Fritz giving instructions to T/4 Frank Houhse, who is in charge of a mobile welding shop used by the U. S. Corps of Engineers for field repairs and maintenance.

» «

Steel-Ribbed Floor

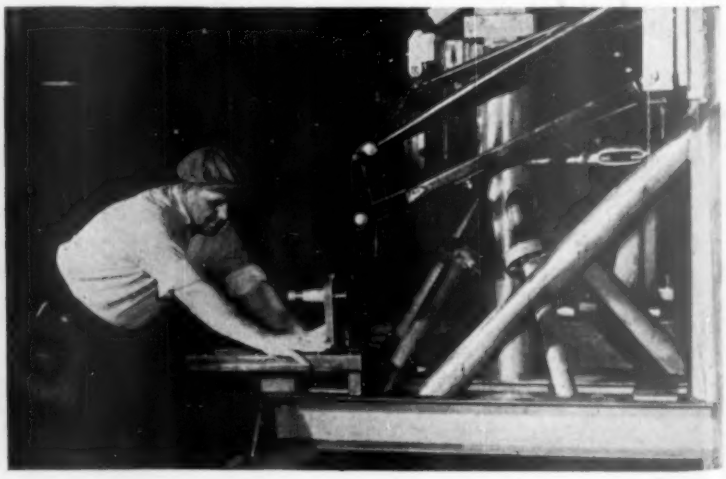
A PATENTED new steel-ribbed floor for trailers was recently announced by the Fruehauf Trailer Co., Los Angeles. The floor boards are supported on the flanges of ten steel ribs. Running substantially the full length of the trailer, the ribs are welded to chassis cross-members and are thus made an integral part of the frame. This type of floor is capable of withstanding a concentrated load of 1,000 psf.

» «

Few and Far Between

FAILURES are few and far between of the landing gears being produced by Willys-Overland Motors for the Navy's Grumman fighter planes. More than 3,500 landing gears were tested without a single failure. The test stand, shown in the accompanying illustration, simulates the structure of the plane's hydraulic mechanism for operating the gear in and out of the fuselage.

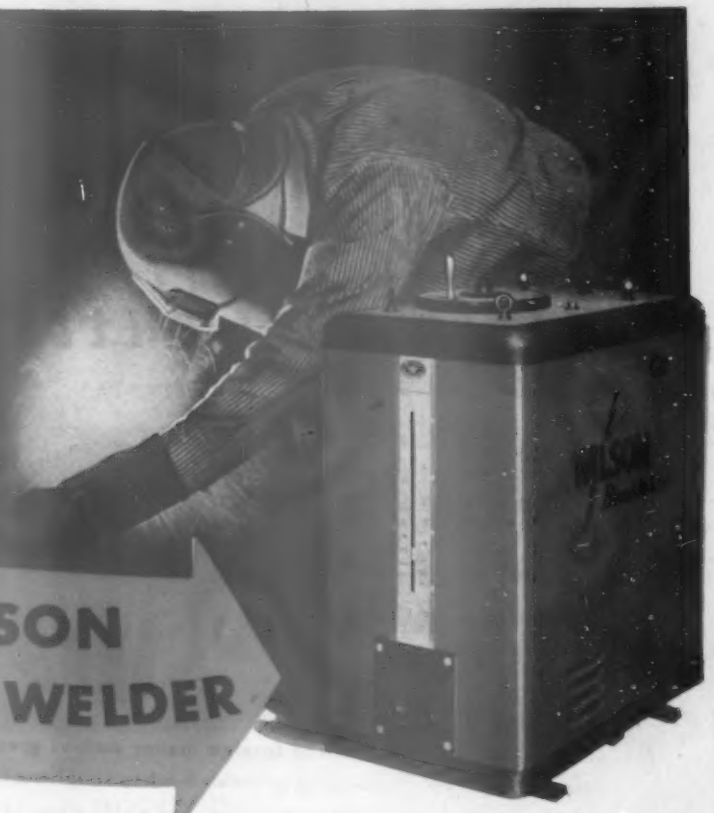
Production of these landing gears was increased 30% through the use of arc welding to join the tubular sections.



This Willys-Overland worker is checking the position of the axle forging in the stand used to test arc-welded landing gears for Grumman fighters.

STEP UP WELDING PRODUCTION 15% TO 30%

WITH THE WILSON "BUMBLEBEE" AC WELDER



Here's the machine that will give you more welding production per work day with considerably less power. It's a sturdy, reliable A. C. welder that provides 15% to 30% *increased* welding production, with 30% to 35% *less* power consumption than equivalent D.C. machines.

NOTE THESE OUTSTANDING FEATURES:

Wide Current Range of 60 to 375 amps. (for 300 amp. "Bumblebee"), and 100 to 625 amps. (for 500 amp. machine).

Improved Electrical Efficiency at rated load of 81% and 83%, for 300 and 500 ampere sizes respectively.

Minimum "arc-blow" increases welding production and makes for easier operation.

Better Power Factor with built-in capacitors helps reduce power costs and relieves loaded power lines.

Maintenance Practically Eliminated because there are no heavy rotating parts.

POWER SOURCE FOR AUTOMATIC WELDING HEADS. 300 ampere and 500 ampere "Bumblebee" machines also are excellent transformers for use with automatic welding units. Connected in parallel they provide ample power, and also permit unusual flexibility in shipyard welding operations.

ALSO MADE IN "ALL-WEATHER" MODELS

"All-Weather" models of the "Bumblebee" have these extra features: (1) Moisture-proof insulation, throughout. (2) All parts are protected by moisture-proof paint. (3) Sturdy weather-proof case is finished in durable outdoor enamel, and has gaskets and louvers designed to exclude rain, sleet, snow. (4) Special low voltage contactor automatically reduces open circuit voltage to about 40 volts.

WE

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TITAN Recommends

4 SIMPLE RULES FOR EFFICIENT WELDING

Strong, sound welds can easily be made. The use of TITAN Brass Welding Rods in line with these four principles will assure welds that are ductile and uniform.

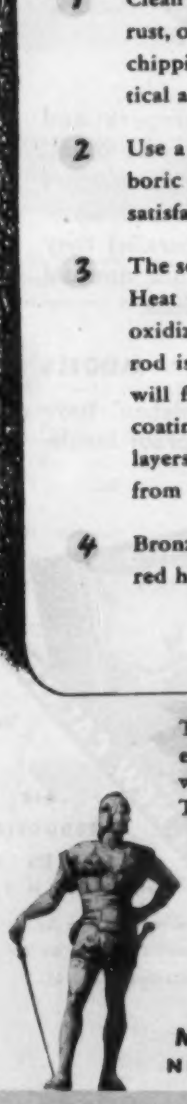
1 Clean weld areas by removing foreign matter such as grease, rust, oil and scale. Surfaces to be welded, when roughened by chipping, give better adhesive qualities. Vee welds when practical are recommended for repairing steel and cast iron parts.

2 Use a good prepared flux. If this is not available, 7 parts of boric acid mixed with 3 parts of calcined borax will prove satisfactory.

3 The section to be welded should be brought to a dull red heat. Heat the welding rod uniformly with a neutral or slightly oxidizing flame and dip it into the flux. The heated end of the rod is then melted on to the preheated section. The bronze will flow away in an even layer and give a good "tinning" coating. Keep building up the section by melting successive layers of rod, holding the inner cone of the flame about ¼" from the puddled surface.

4 Bronze rods and welds should not be brought beyond a dull red heat because they can be burned by overheating.

TITAN'S doubly deoxidized bronze welding alloys penetrate seams and crevices readily. They are the favorite with welders who know the importance of uniformity. Try them today and you will demand them tomorrow.



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Aid to Army Cooks

ARMY cooks need big ranges in order to give the G.I.'s their chow. At Washington Stove Works, Everett, Wash., these ranges were once riveted. The process required 1½ hr or longer per range, however, and that was too long. Now production time for the same assembly has been cut to 15 minutes or less by using spot welding.

Courtesy, Progressive Welder Co.

This heavy-duty spot-welding gun is used to assemble large cooking ranges to feed Service men.

As the body of a large range is too heavy to be spot welded on conventional stationary equipment, a special heavy-duty portable spot-welding gun was developed to do the job. This equipment is suspended by cables from above and counterbalanced so that it can be moved in any direction. The electrodes can thus be readily brought to bear on any desired point of the range body. The possibilities of either burning the metal or underwelding are eliminated by automatic time and heat controls.

The stove company plans to use the same type of installation to produce and improve the quality of its commercial ranges in the postwar era.

» «

It's Not Over Yet!

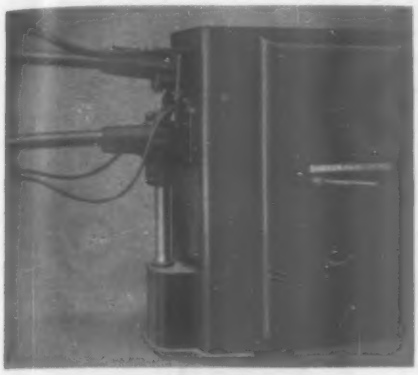
EVEN if Germany crumbles this fall, the U. S. Navy anticipates a long, hard war with Japan. Just to prosecute the war against Japan, said Secretary Forrestal, the Navy will need a production of five ships every two days.

No, the war won't be over when Germany capitulates, and don't let it stop anywhere on the home front until we achieve total victory. The 6th War Loan is coming up late this month or early in December. Buy bonds to beat the baboons that fight under the flag of Nippon!

New Products to Use

Storage-Battery Welders

★Two new models have been added to the Progressive line of storage-battery-powered resistance welders. The first



"Economy" spot welder powered with storage batteries. Operation is from normal factory air-line pressure. The electrical system consists of six special three-cell "welding" batteries. This model has a throat depth of 24 in. and a rated capacity of two pieces of 14 gauge mild steel or two 0.040 in. thicknesses of aluminum.

in an "economy" spot welder (see illustration) of the rocker-arm type, wholly self-contained: the storage batteries, contactor-controller and variable heat-control regulator are all enclosed in the base of this machine.

The second machine is of the heavy-duty type. The batteries—also contactors, battery chargers and controllers—are housed in standardized "power-pack" units. This model is so designed that it can perform both spot and roll-spot (seam) welding with but minor changes.

In addition to their ability to weld ordinary mild steels, both of these models will handle the spot welding of stainless steel and aluminum. The heavy-duty welder will spot weld structural aluminum up to two $\frac{1}{8}$ in. thick sections. **Progressive Welder Co.**, 3050 E. Outer Drive, Detroit 12.

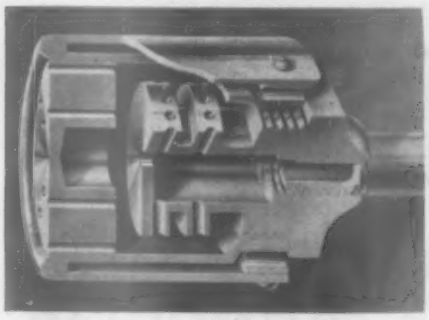
» «

Multiflame Heating Nozzles

★ A new heating nozzle particularly designed for use with oxygen and the liquefied petroleum gases or natural gas is offered by **Victor Equipment Co.**, 844 Folsom St., San Francisco 7. The nozzle incorporates an outer air mantle to protect the head against deflected heat. The internal design is such that the cool and premixed gases carry away a substantial amount of accumulated heat, and in so doing become preheated to the temperature proper for combustion.

This heating nozzle fits all standard Victor welding torch butts and is also sold as a complete torch unit. Similar multiflame heating nozzles are likewise available in various sizes for use with oxygen and acetylene.

The larger multiflame heating nozzles are recommended for flame-priming and descaling in inaccessible areas. All of them, it is stated, can be employed for various silver-brazing operations as well as for preheating and bending.



Victor multiflame heating nozzle. It is designed for use with oxygen and natural gas, can be attached to any standard welding torch of this make.

» «

Crushproof Socket

★ A new development in molded watertight pigtail sockets has been put into production by **C. H. Stevens and Co.**, 216 E. 45th St., New York City 17, and 3216 Sacramento Blvd., Sacramento, Calif. This new socket has an unique internal construction claimed to render it crushproof. Instead of the usual stamped shell, the rubber is molded over a coiled spring of heavy brass wire, which, it is stated, will not crush even if run over by a truck. The center contact floats in live rubber and has a replaceable contact button. Long, extra flexible pigtail wire (82 strand, No. 33) is used, being molded to the body in order to eliminate the break-offs caused by heavy strain.

Stevens "Tuffline" No. 77 socket is made to withstand the uses and abuses of shipyards.

» «

Multiflame Heating Torch

★ A medium-weight Airco heating torch, Style 9802, has been designed for concentrated localized heating such as is required for the silver brazing of

Airco Style 9802 torch is used to apply concentrated local heating.

heavy copper plates or for the bending, straightening and shrinking of steel plates. Lighter in weight than former heating torches used for such purposes, the new model is said to have equivalent gas capacity.

Five oxy-acetylene heating tips and two oxy-propane heating tips are available for this torch. Three mixers are available: for positive pressure acetylene, for low-pressure acetylene and for propane. The available extensions include a 12 in. straight extension and 18, 24, and 42 in. angular extensions. **Air Reduction Sales Co.**, 60 East 42nd St., New York City 17.

» «

Tool-Steel Electrode

★ Amsco "Toolface" is a new high-carbon, high-chromium, molybdenum-, tungsten- and vanadium-bearing electrode or welding rod of the composition commonly known as high-speed steel. It has a guaranteed Brinell hardness of between 575 and 675. It can be used as a general hard-facing rod where extreme hardness and resistance to shock are of primary importance. It is also used in the manufacture of composite cutting tools for lathes, shapers, etc.; in the manufacture of composite forging dies, rock drill bits; for the salvage of worn or broken high-speed-steel parts.

The "Toolface" rod may be applied by either gas or arc welding. **American Manganese Steel Div. of American Brake Shoe Co.**, Chicago Heights, Ill.

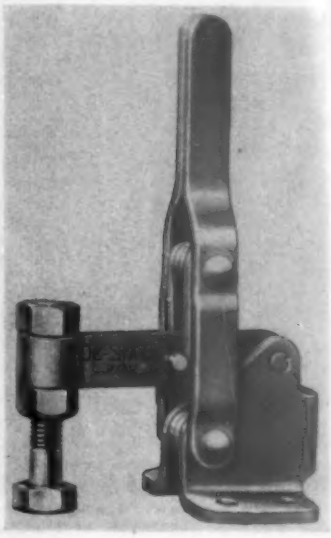
Face Shield

★ A lightweight protective shield, Type V-1, for the face and forehead has been developed by **Willson Products, Inc.**, Reading, Pa., to safeguard operators doing such work as spot welding, light grinding and wood working. The shield is made to fit over prescription spectacles and to extend well back along the sides of the face. It is featured by an adjustable headband, front cushioning with a replaceable leather sweatband, back cushioning with a pliable plastic tube, a lightweight brow guard to protect the forehead and a combination friction swivel and guard. The latter device permits easy raising of the shield but prevents blows from pressing it against the face.

Slot locks hold the replaceable cellulose-acetate visor in place; an aluminum edge prevents warping. The shield may be obtained with either a clear or a green visor in 4, 6 or 8 in. lengths.

Willson "Protecto-Shield" (Type V-1) for operators performing light-duty operations such as spot welding.

» «



"De-Sta-Co" Model 202-A, a lightweight aluminum clamp.

Aiuminum Toggle Clamp

★ Model 202-A is a new all-aluminum light-duty toggle clamp developed by the **Detroit Stamping Co.**, 372 Midland Ave., Detroit 3, for use on portable or spot-welding fixtures. The clamp measures 2½ in. long, 1⅝ in. wide, 3¼ in. high (when in locked position) and weighs less than 3 oz, including hold-down spindle and adjustment nuts. It should prove useful wherever a lightweight, small-size clamp is needed.

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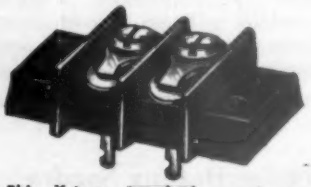

This Y-type terminal mounts on standard barrier strips and permits screw connection above panel.

Terminal Strip

★ To meet the demand for a barrier-type terminal strip with facilities for connections both above and below the mounting surface, **Howard B. Jones Co.**, 2460 W. George St., Chicago 18, has designed a Y-type terminal which permits a screw connection above the panel and a solder connection below, as shown in the illustration. The Y terminal mounts securely in the block and is also held by the screw so that the connecting wire comes in direct contact with the terminal. It is made for the No. 140, 141 and 142 series barrier strips, the letter Y being added to the standard code numbers to designate this type of terminal.

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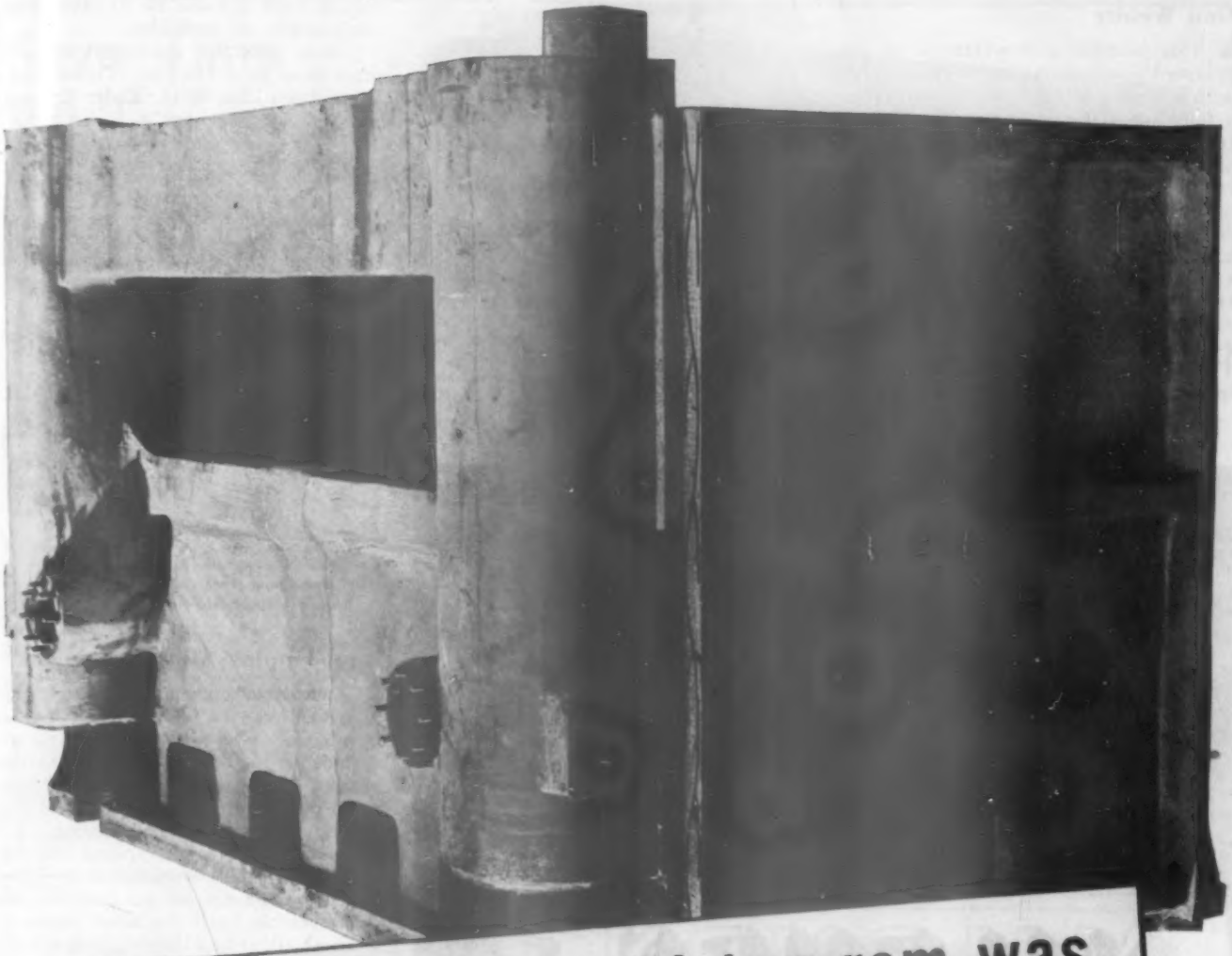


In 72 hours this 24-ton ram was repair-welded with TOBIN BRONZE

A large hydraulic press was busily engaged in the war production work of a well-known manufacturer, when this 14-ft. x 8-ft. x 8-ft. ram broke. Next day it was sent to the Super Arc Welding Company, Detroit, Mich. for repair. Just 72 hours later the press was back on the job forming aircraft parts. Ten welding operators and four helpers, working in shifts, had used some 750 pounds of Tobin Bronze* Welding Rod to restore the broken internal ribs and front face of this expensive piece of equipment.

This is another example of the outstanding wartime repair welding being done with such rods as Tobin Bronze and Anaconda 997 Low Fuming. Their worth is emphasized today when prolonged equipment life is so important. Publication B-13 gives full details—copy on request. 4376

*Reg. U. S. Pat. Off.

KEEP BUYING WAR BONDS REGULARLY

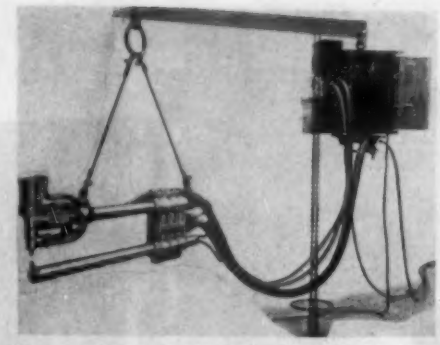
ANACONDA *Anaconda Welding Rods*

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Co. • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

Gun Welder

★ This portable gun welder is an air-operated spot-welding machine equipped with a double-acting cylinder and either a fully automatic or semiautomatic control. The power part consists of an air-cooled transformer with an eight tap switch for heat regulation, a pneumatic or electronic-actuated timer and a mechanical or electronic contactor. The weld cycle can be initiated by either a foot switch or a push-button. The air system includes solenoid-operated air valves, air filter, pressure regulator, gauge and switch and an air-line oiler. The welding gun is free swinging, counterbalanced against the weight of the transformer and can be mounted either horizontally or vertically.



Eisler portable air-operated adjustable gun welder. It was designed for spot welding at places hard to reach with a stationary machine.

These units are manufactured in all sizes from 30 to 150 kva. Throat depths range from 12 to 48 in. **Eisler Engineering Co., Inc.,** Newark 3.

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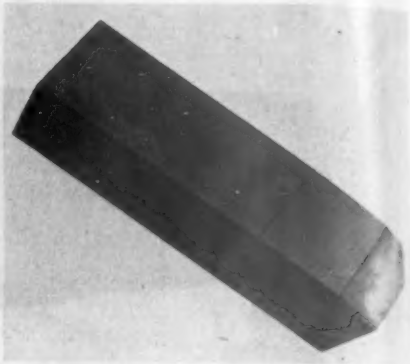

The tipping of tungsten-carbide or high-speed-steel tools can now be done with powdered, prefluxed alloys.

Tool-Tipping Alloys

★ Two silver-copper and one copper alloy, all available in the form of a fine powder, are offered for joining tungsten-carbide or high-speed-steel tips to their shanks. The required flux is mixed right in with the powdered alloy, eliminating the operation of fluxing. It is only necessary to: (1) spread the powdered alloy on the surfaces to be joined, (2) place the tip on top and (3) heat the assembly until the alloy melts.

These alloys and their melting temperatures are: Eutecrod 1800 (lowest melting) for high-speed steel, 940-1,140 F; Eutecrod 1601 (high tensile) for tungsten carbide, 1,020-1,250 F; Eutecrod 16 (heat-resistant high tensile) for tungsten carbide, 1,300-1,750 F. **Eutectic Welding Alloys Co.,** 40 Worth St., New York City 13.

» «

These Kimball goggles are featured by Tenite plastic frames and large, changeable lenses.

Safety Goggles

★ Safety goggles with lightweight frames of shatterproof Tenite plastic are offered by **The Kimball Safety Products Co.,** 7314 Wade Park Ave., Cleveland 3. Lenses are extra large, permitting unobstructed vision, and are interchangeable so that different colors may be inserted.

Milburn Type N Cutting Torch. Meets Highest Performance Standards.
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How TO SPEED UP WELDING OPERATIONS!

Use This Dual Automatic Welding Fixture!

Automatic Welding-head Positioner — adaptable to your own holding fixture.

THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

WRITE

for information relating to your particular welding fixture problem

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Detroit 7, Michigan

In Canada: C. H. Henze Co., Windsor; Hollup Corporation, Limited, Toronto; Leavitt Safety Appliances Co., Toronto; Paragon Supplies, Limited, Vancouver; Flecks Bros. Limited, Vancouver.

Conversion Plug-in Timer

★ The new Weltronic Universal timer has interchangeable "plug-in" control panels which are said to make possible the conversion of timing controls to any of the standard NEMA types within a few seconds. Thus any resistance welder can be made almost immediately available for any type of welding within its capacity.

Each of these weld-and-sequence timers is a self-contained package unit incorporating: (1) a cabinet-and-power-supply unit and (2) a series of individual control panels that can be interchanged without the use of tools or rewiring. The rapid interchange is made possible by means of a slotted-hinge type of mount, which reduces the removal of a control panel to a simple swing out, pull plug and lift off operation. The power supply unit is adaptable for 115, 230, 575 or 460 volt, 50/60 cycle a-c service by merely shifting one jumper.

Interchangeable plug-in control panels on the new Weltronic Universal timer permit the conversion of a resistance welder to any of the NEMA timing types.

The entire unit is mounted on a single panel that can be removed for servicing by taking out four screws. Fully electronic precision timing is provided for wide ranges of welder electrode movement and pressure sequences. **Weltronic Co.**, 19500 West Eight Mile Road, Detroit 19.

» «

Removable roller top for Lyon-Raymond elevating table. It conveys work from either front to back or from side to side.

Roller Table Top

★ A removable and reversible top is now offered as an optional feature of the Lyon-Raymond hydraulic elevating table. The roller top consists of a rigid welded framework supporting ball-bearing conveyor rolls. The framework fits down over the permanent top, making immediate installation or removal of the rollers possible. Since the top of the hydraulic elevating table is square, the rollers can be placed to convey from either front to back or from side to side. **Lyon-Raymond Corp.**, 1814 Madison St., Greene, N. Y.

» «

Tip-Cleaning Solution

★ "Tip Cleen" is a prepared solution to remove the impurities and deposits which settle in a torch tip and in time clog it up. To clean tips by this method, the solution is heated to 150 F and the tips are left in it for four hours. They are then removed and rinsed in cold water. The method, states manufacturer, eliminates the use of drills and is wholly non-injurious to the tips. **Wolfe-Kote Co.**, Sheboygan, Wisc.

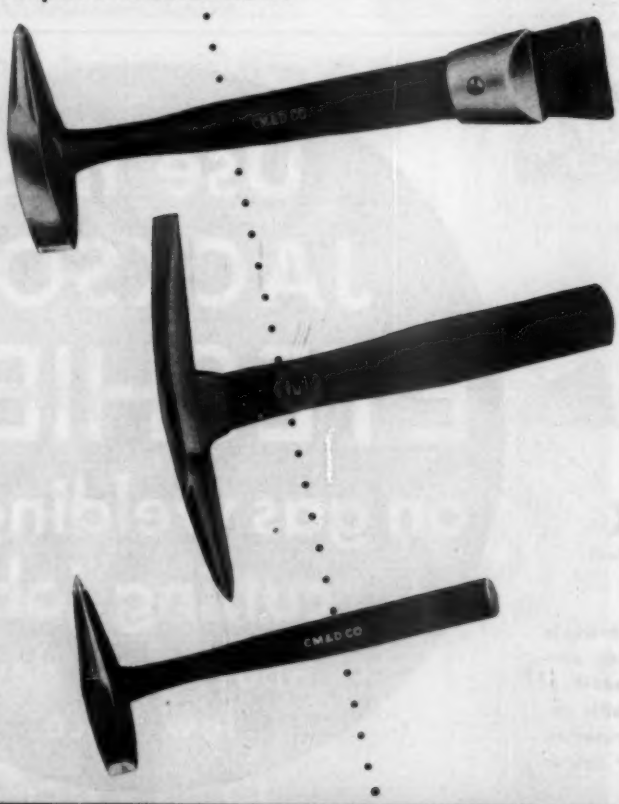
Ask for CMD WELDERS' CHIPPING HAMMERS

A type for every weld cleaning need. Cutting edges stay sharp a long time. Write Department 4W for descriptive circular now!

TYPE CB
Triple Duty
Combines 3 tools in 1—drift, chisel, and removable wire brush.

TYPE A
Drift and Chisel
Made from high-grade tool steel. Especially popular in malleable iron and grey iron foundries for general chipping.

TYPE C
Drift and Chisel
Same as Type CB but without brush.

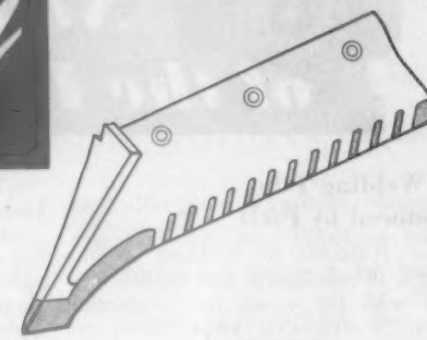


CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

Resisto-Loy

HARD-SURFACING ALLOY

for AGRICULTURAL PURPOSES



Tests prove that plowshares hard-faced with Resisto-Loy alloys along cutting edge and point stand up under five times as much wear with greater efficiency.

Use Resisto-Loy to put a sharp cutting edge or tough face on general agricultural equipment. Easily applied, unsurpassed for building up separator cylinder teeth, disc plows and harrows, cultivator points, bean knives and feed mill hammers.

Resisto-Loy COMPANY
GRAND RAPIDS 7, MICHIGAN

C-F

POSITIONERS

"Position" Counts Most in this Heavy Welding Operation

Production welding usually means working on top, bottom and on all sides of the weldment. It means a "quick change" of position should be possible for greater time saving, more efficiency, lower costs and greater safety to men and materials. With C-F positioners a welder can quickly position even the most cumbersome weldments at the press of a button, without crane help or handling crews. With just one set-up of the weldment he can position it easily, speedily and safely, all alone. He can rotate it a full 360° at variable speeds from 0 R.P.M. up, tilt it to 135° beyond horizontal, and can weld, down-hand, all sides, surfaces and angles in the one set-up with larger rods and fewer passes. All C-F positioners, both stationary and portable, are pedestal mounted to give maximum floor and working clearance and all are adjustable for height.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO.

1309 S. Kilbourn Ave. Chicago 23, Ill.

News of the Industry

New Welding Film Announced by P&H

"New Horizons in Welding" is the title of a 16 mm sound film dealing primarily with the set-up for production welding. A 30-minute presentation, the film will be made available to all interested groups — manufacturers, trade schools, Government departments, etc. —by its producer, the Harnischfeger Corp.

The picture opens on the theme that welding has risen from a mere implement of repair to a major production tool. . . "A gleam that has grown from a glimmer and multiplied 500 times in ten years." The camera moves behind the scenes in a large manufacturing plant where "all-welded" applies to some 10,000 different items. Here are shown the experimental laboratories in which various metals and electrodes undergo rigid tests. Here, too, are the template department . . . the set-up man, key figure in the production-welding scheme . . . time- and labor-saving cranes, hoists and welding positioners. As a climax, an arc timer is shown in action, recording the exact time that each welder's arc is in actual operation.

Readers interested in "New Horizons in Welding" for exhibit purposes may secure additional information by addressing M. H. Rutishauser, manager of the P&H welding division, the Harnischfeger Corp., 4400 West National Ave., Milwaukee 14.

» «

"Jobs for Servicemen" New Slogan at Carnegie-Illinois

A broad program looking to the re-employment of as many as possible of the nearly 43,000 Carnegie-Illinois Steel workers inducted in the armed forces has been set up at Gary, Ind., under the direction of General Foreman Maynard G. Montgomery. Mr. Montgomery is a former soldier of World War I and also chairman of the Gary Draft Board 7.

To date, Carnegie-Illinois Steel Corp. has employed more than 4,000 veterans of World War II, of whom 2,000 are former employees. Special attention is being given to handicapped veterans.

» «

Concrete Column Makes Cheap Steel Substitute

A light, cheap substitute for structural steel columns has been developed in Northwestern University's Technological Institute at Evanston, Ill. According to *Pathfinder*, national news-weekly, it is reported stronger than steel and as light as aluminum.

The new column is composed chiefly of concrete. Inside a spiral steel wire, a metal lining is placed and filled with concrete. The water content of the latter is cut to about one gallon per sack of cement and it is compressed by a steel plunger. The steel wire is expanded by the compressed concrete and adds to the column's strength. Tests on a small model, 80% concrete and 20% steel, have indicated that the combination will support heavier loads than a steel column of comparable size.

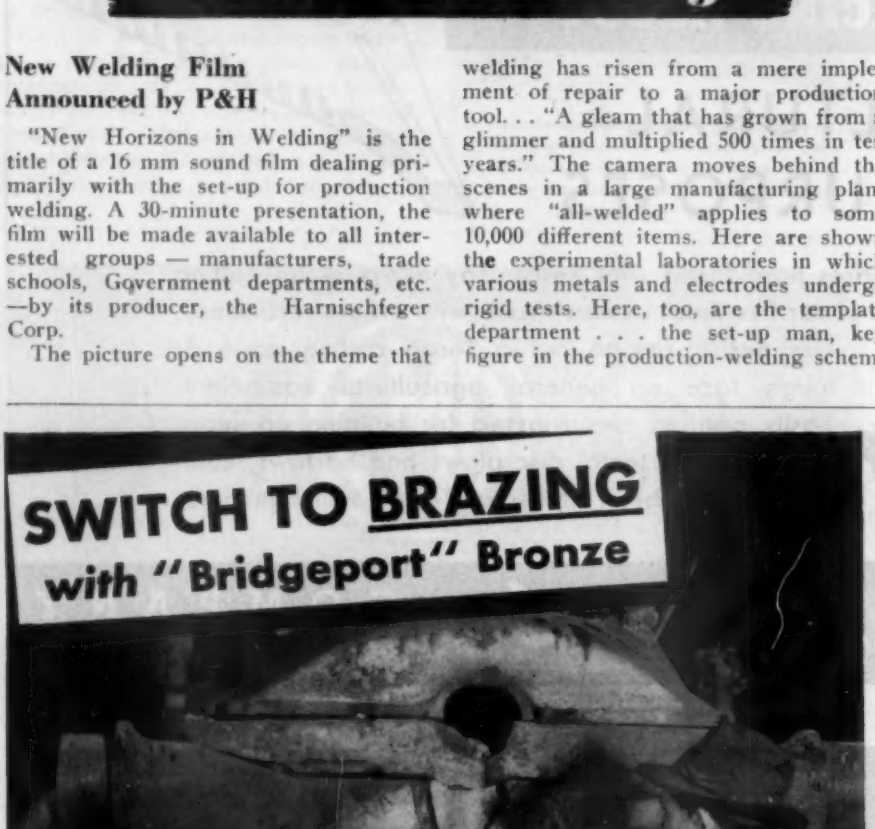
The idea was supplied by Professor George A. Maney, chairman of the civil engineering department, who predicts that it will conserve iron ore reserves, reduce building costs and so help materially to rebuild the war-torn cities of Europe. Cost of production is said to be 67% less than the comparable cost of steel.

» «

Lukens Steel Co. Licensed to Manufacture "Cor-Ten"

Executives of the Carnegie-Illinois Steel Corp. revealed recently that the Lukens Steel Co., Coatesville, Pa., has been licensed to manufacture "Cor-Ten" corrosion-resisting steel. Hitherto, this high-strength, low-alloy steel has been produced solely by subsidiaries of the U.S. Steel Corp.

SWITCH TO BRAZING
with "Bridgeport" Bronze



5-TON BRASS MELTING FURNACE REPAIRED
with No. 192 Low Fuming Bronze

FACTS for WELDERS... Here's the most practical, up-to-date data on selecting and using welding rods for best results. Write for your copy.

Time and again it has been demonstrated that brazing with Bridgeport Rod can accomplish jobs "impossible" with other welding methods and materials. Because brazing requires only *local preheating of the base metal to a cherry red*, dangerous stresses and local brittleness caused by excessively high temperatures are eliminated. Frequently the brazed part is considerably stronger than before.

In this case brazing saved the cost and delay of a new casting, machining, assembling and relining with fire brick. What is more important it prevented a serious loss in production of vital war materials.

For your next "impossible" job, switch to brazing and specify "Bridgeport" bronze rods—low melting point, easy flow, good tinning action, and exceptional *adhering* properties.

Write for free booklet containing practical suggestions on the selection and use of Bridgeport Bronze Welding Rods.

BRIDGEPORT BRASS

"Bridgeport" BRIDGEPORT 2, CONN. • ESTABLISHED 1865
BRIDGEPORT BRASS COMPANY

Pullman-Standard Plans New "Day-Nite" Coaches

A long-distance railway car which can be built of either steel or aluminum alloys has been designed by the Pullman-Standard Car Mfg. Co. to give overnight coach travelers "chaise lounge" sleeping comfort. At night the passenger can obtain a full-length sleeping surface simply by pulling down a large upholstered leg rest from the back of the seat ahead.

The third radically new type of railway car to be announced for postwar railroad travel, the "Day-Nite" coach also embodies improvements in luggage handling, private dressing and wash rooms for both men and women passengers, and individually controlled lights. It can be built as soon as wartime restrictions are removed, according to Ellis W. Test, assistant to the president in charge of engineering and research.

» «

Ergolyte Mfg. Co. Buys Precision Engineering Co.

Equipment and inventory of the Precision Engineering Co., 4632 W. Armitage St., Chicago, has been purchased by the Ergolyte Mfg. Co., 3627 N. Lawrence St., Philadelphia. William Dickey, the former owner of the Chicago company, has been retained in an executive capacity by the Philadelphia concern.

Both of these companies started in business in 1940. The Precision Engineering Co. specialized in the manufacture of small welders that were sold mainly through mail-order houses. The Ergolyte company has concentrated on the contract welding of war materials and on the production of a-c arc welders. The acquisition of the Chicago plant will play an important part in the development of its postwar welding equipment, declared President John H. Read. "We will be prepared," he said, "to market new and improved welding machines for peacetime production, and we expect remarkable developments in this field.

» «

Feature Plant Equipment at National Power Show

Equipment for the control and distribution of power will be the feature of principal interest to visitors at the 16th national Exposition of Power and Mechanical Engineering, which opens in Madison Square Garden, New York City, on November 27 and will run until December 2.

Also on display will be a large number of mechanical engineering exhibits such as drafting room and laboratory equipment, instruments for registering, recording and regulating pressures, temperatures, liquid levels and flows, etc.

Attendance at this year's Power Show is expected to approach the prewar levels of 30,000 to 40,000 visitors. There will be a 15% increase in the exhibitors' list over the 1942 show.

Cutting Tools Made, Altered or Salvaged with TOOLFACE

New Amsco High Speed Steel Electrode Saves Time, Cuts Costs For Toolmakers

Toolface—the newest member of the family of Amsco welding products—is a high carbon, high chromium, molybdenum, tungsten and vanadium bearing welding rod commonly known as high speed steel. Deposits have a Brinell hardness of between 575 and 675.

Toolface is being used for manufacturing composite cutting tools, such as those employed on lathes, shapers, milling heads, etc. Its ready weldability expedites the depositing of cutting edges or lands on mild steel bases or shanks. This method, plus its high degree of hardness, results in substantial economies in tool making. Toolface cutting surfaces can be readily dressed.

Other applications for Toolface include making composite forging dies and rock drill bits. It is also used for altering tools and for salvaging high speed tool steel parts that become broken or worn due to impact or abrasion.

Toolface can also be used as a general hard surfacing rod where extreme hardness and resistance to shock are of primary importance.

Write for full information on Amsco Toolface.

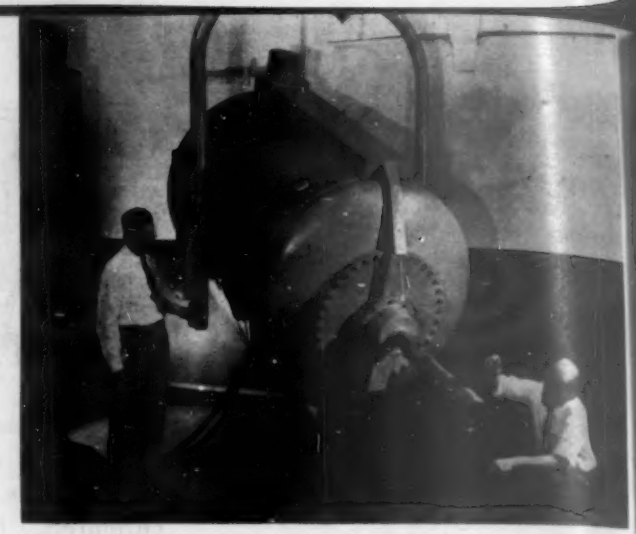
Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

AMERICAN Brake Shoe COMPANY

12 in. of Solid Steel No Bar to New X-Rays

"Hard" X-rays that will take a picture through steel pieces a foot thick are produced by the new 2,000,000-volt mobile X-ray unit developed in the research laboratory of the General Electric Co., Schenectady, with the assistance of the engineering staff of General Electric X-Ray Corp., Chicago.

First announcement of the high-voltage device was made at the recent National Electronics Conference in Chicago by the scientist in charge of the work, Dr. Ernest E. Charlton. In the paper presented by Dr. Charlton and his collaborator, Willem F. Westendorp, it was explained that the two-million-volt X-rays will make a satisfactory exposure through a foot of steel in about two hours, using the Types A X-ray film at a distance of three feet from the end of the tube. For practical purposes such a thickness is opaque to million-volt X-rays, hitherto the most powerful in service.



Dr. Ernest E. Charlton (left) and Willem F. Westendorp check the two-million-volt X-ray outfit developed in the X-ray section of the General Electric research laboratory. A steel section 1 ft thick can be examined radiographically with this new apparatus.

In radiographing an 8 in. steel casting, the two-million-volt outfit is 78 times as fast as the million-volt apparatus. In one experiment, a period of 4½ hours was required to make an exposure through steel of this thickness with a million volts. Two million volts did the job in *3½ minutes.*

The new unit weighs 5,000 lb but is mobile, Dr. Charlton explained, in the sense that it can be readily moved by crane and positioned at any angle by push-button control of fractional hp motors. Steel castings of the thicknesses for which it would be used might weigh on the order of hundreds of tons.

Like its predecessor, the two-million-volt apparatus makes use of a multiple-electrode tube in which the electrons are speeded in stages. The new tube has 24 steps, averaging 83,500 volts at each stage. At full speed, which is about 179,000 miles per second or 96% of the velocity of light, the electrons strike a copper-backed tungsten target and cause the emission of X-rays from the end of the tube.

Construction of the new tube, Dr. Charlton's paper explained, was made possible through the use of rings of fernico between the sections of glass. Fernico is an alloy which has the same coefficient of expansion as glass and so can be fused with it without danger of breakage.

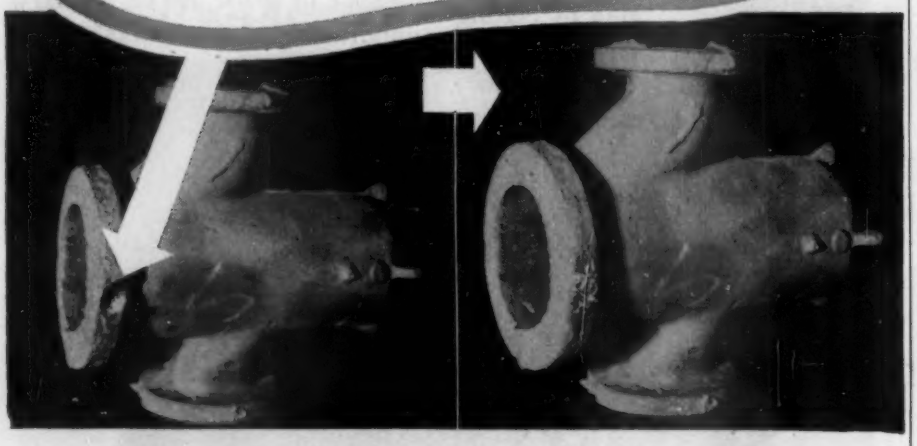
» «

Mine Safety Appliances Awarded Army-Navy "E"

Mine Safety Appliances Co., Pittsburgh, has joined the ranks of the 25 select U. S. manufacturers who hold both the Army-Navy "E" and the Maritime "M." The Army-Navy pennant was recently presented by Rear Admiral C. H. Woodward, USN (Ret.), chief of the Incentive Division of the U. S. Navy. The Pittsburgh concern already had a four-star Maritime "M."

The best way out of this hole is to weld with

PHILLIPS "600" ELECTRODE



5 minutes welding with PHILLIPS "600" Electrode saved this 180-lb iron casting from the scrap pile

IT is the work of a very few minutes, and it takes only a few cents' worth of material, to restore this gray iron casting completely. After machining the weld cannot be distinguished from the parent metal, because PHILLIPS "600" deposits are the same color as cast iron. And there is no difficulty about machining, drilling, tapping, etc., because the deposit is fully machinable, *including the line of fusion.*

Consult with Phillips on all cast iron salvage, maintenance and repair problems. There is a correct rod for every application of electric arc welding to cast iron, and Phillips has it. There is also a correct procedure for each of these applications—and Phillips can supply it.

This new manual is a complete guide to the selection of materials and procedures for arc welding cast iron. Send for your copy TODAY.

C. E. PHILLIPS & COMPANY

2750 Poplar Street, Detroit 8, Michigan • 332 So. Jefferson St., Chicago 6, Illinois

MANUFACTURERS AND DISTRIBUTORS OF WELDING ELECTRODES AND SPECIALTIES

Gasweld

G-W PORTABLE
FLAME CUTTING MACHINE

● The "Gasweld" G-W Flame Cutting Machine is a portable, motor driven torch for cutting billets and straight lines, strips, circles, arcs or simple irregular outlines in steel plates. Either straight or beveled edge cuts are easily made.

Cuts can be made clean and accurate, eliminating in many cases, the need for further machining. Light, compact—weighing only 45 pounds—the machine is easily moved from place to place in the shop. Speed range —four to sixty inches per minute; travels either forward or in reverse direction.

The G-W Portable Flame Cutting Machine effectively lowers cutting costs and speeds production over hand-cutting methods.

Write for illustrated bulletin and price to

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WALL CHEMICALS DIVISION of
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THE BIGGEST NEWS IN WELDING TODAY!

STEVENS
TUFFLINE
WELDING RESISTOR UNIT

IMMEDIATE DELIVERY $96.00 LIST PRICE

Discounts on Request

Generators are hard to get . . . expensive. Even with high priorities, deliveries are long delayed and uncertain. The remedy for this situation is to install STEVENS TUFFLINE WELDING RESISTOR UNITS. They multiply your generating capacity by 3 and 4 times at a small fraction of the cost of additional generators.

Thousands of Stevens Welding Resistor Units are working night and day on production lines from coast to coast, including nearly 75% of the nation's shipbuilding concerns. Demonstrations of any Tuffline product given without obligation. Catalogs showing all Tuffline products sent upon request.

MODEL C,
200 Ampere
capacity in 10
Ampere steps

C. H. STEVENS & COMPANY 216 E. 45TH ST., NEW YORK 17, N. Y. TEL.: MU 2-4894
SACRAMENTO, CALIF.: 3216 SACRAMENTO BLVD.,
SACRAMENTO 5-2388

Power-Load Problem Solved for Resistance Welders

Improvements in the design of resistance welders and excellent coöperation between manufacturers, users and power company officials have solved the power-load problem and eliminated the difficulties formerly encountered when resistance-welding equipment was connected to power lines.

The above opinion was voiced by A. D. McLay, vice-president of The Detroit Edison Co. in charge of sales, in a recent talk before members of the Resistance Welder Manufacturers Association. Fifteen or twenty years ago, he reminded his listeners, the installation of resistance welders would cause the electric lamps of other consumers to flicker or grow dim and also cause interference with the power supply of nearby factories. Today all of that is gone.

» «

Rheem Buys Stokermatic

Rheem Manufacturing Co. has acquired the business of Stokermatic Co., Salt Lake City manufacturer of automatic coal stokers, stoker-fired water heaters and basement furnaces. The Stokermatic patents will permit Rheem to add a coal-burning automatic water heater to its present line of gas, electric and oil heaters.

Wayne Welding Has 25th Anniversary

Wayne Welding Supply Co., Inc., Fort Wayne, Ind., will celebrate its 25th year as a welding distributor with a two-day welding conference on Dec. 5 and 6. There will be demonstration lectures and movies as well as an exhibit of the nationally advertised products distributed by the Fort Wayne firm.

Starting in Dec., 1919, Wayne Welding Supply has grown until it is now the largest distributor of welding products in the Fort Wayne trading area. The company also operates an apparatus repair depot and a job welding shop.

» «

Tube Companies Merge

Tubular Alloy Steel Corp., Gary, Ind., has become an operating division of National Tube Co. Both of these concerns are subsidiaries of the U. S. Steel Corp.

Tubular Alloy Steel Corp. was launched early in 1942 to increase the production of seamless alloy-steel tubing essential to the war effort. The latest move does not change the existing arrangement with Defense Plant Corp., which continues to hold title to the mechanical facilities and other equipment.

No Vibration in New "Orbital Action" Portable Electric Sander; Relieves Workers' Fatigue

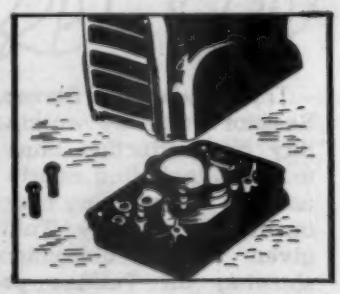
A boon to workers' nerves and health, this new "Orbital Motion" electric sander is actually vibrationless. A great saver of workers' energy as well as man-production hours, the sander can be operated easily in horizontal, vertical or inverted position with one hand. Compared to manual sanding, this machine achieves superior results at least eight times faster. It performs equally well on wood, metal or plastics.

Developed for war industry, this revolutionary new sander has done yeoman duty in this country's manufacturing plants and in allied maintenance and repair depots all over the world.

Wrigley's Spearmint Gum renders a real service to workers too—eases dry throat and relieves tension that brings on fatigue, leaving both hands free to stay on the job. The Army and Navy were quick to appreciate these benefits, that's why they are now shipping to our fighting forces overseas only, our entire limited production of Wrigley's Spearmint. Just as soon as we can supply the home front, too, industry will again enjoy the benefits of Wrigley's Spearmint Gum now proving so important on the battle fronts.

You can get complete information from Sterling Tool Products Company, 155 East Ohio Street, Chicago 11, Illinois

Easily-removed filter cleans air that cools motor—prolongs motor life and reduces maintenance costs.



Dustproof transmission synchronized to eliminate vibration. Oil supply lubricates for 100 operating hours.

Y-160

ABOUT PEOPLE

John D. Gordon, formerly general manager of Taylor Winfield Corp. and recently executive assistant to the president of Federal Machine and Welder Co., has joined the Progressive Welder Co., Detroit, as general sales manager. He will direct both the activities of the field sales organization headed by E. J. DelVecchio and the local sales organization headed by Harry J. Rose.

» «

K. Swanson, formerly chief engineer of Federal Machine and Welder Co., has joined Progressive Welder Co. in the same capacity. **W. Kaiser,** formerly development engineer with National Welder Co., will assist in further development and application engineering on the new P.W.C. battery-welder line (see page 79).

» «

C. S. Becker has been promoted to chief of the liquid, gas-handling and welding equipment branch of the general industrial equipment division of WPB. He succeeds **William M. Haile,** recently made director of the general industrial equipment division. **H. R. Smith** has been promoted to chief of the arc, gas welding and cutting equipment section. **P. M. Hall** continues as chief of the resistance welding section.

Anti-Spatter

"FOR BETTER WELDING"

ANTI-SPATTER practically eliminates oxidation—cuts down the amount of slag covering weld. It also fortifies the action of rod coating—less slag, easier to remove. Weld rust practically eliminated.

Easy to apply—simply brush on before welding. After welding, **ANTI-SPATTER** is easy to remove. If surface is to be painted, remove with wet cloth or usual degreasing methods—otherwise use dry rag.

Get speedier and better looking production and save man hours in costly cleaning. **ANTI-SPATTER** is non-inflammable, non-toxic and has no disagreeable odors.

WRITE TODAY FOR DESCRIPTIVE FOLDER ON ANTI-SPATTER

TRI-FLUX
A new and hotter soldering flux.
No. 5 for Stainless and Monel Metal.
No. 3 for All other metals.
Write for details.

Distributors write us.

FLAME-PRUF
Ideal protection for welders' clothes.
Odorless, low cost, easy to use.
Write for details.

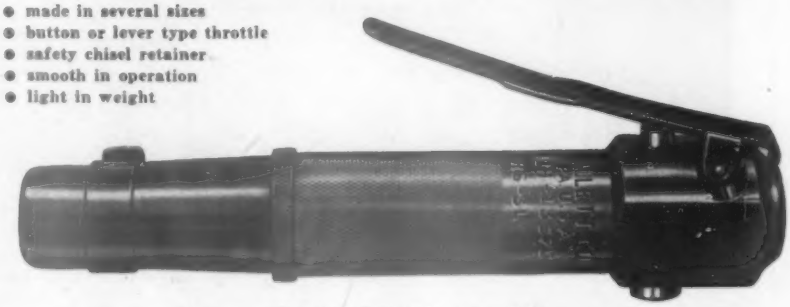
THE WOLFE-KOTE CO.

SHEBOYGAN • WISCONSIN

DALLETT Pneumatic Weld-Flux Scaling Hammers

Especially designed for roughing, peening, removing flux and excess metal resulting from welding operations.

- made in several sizes
- button or lever type throttle
- safety chisel retainer
- smooth in operation
- light in weight



write for Bulletin No. 500

THE DALLETT COMPANY

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PHILADELPHIA 33, PENNSYLVANIA

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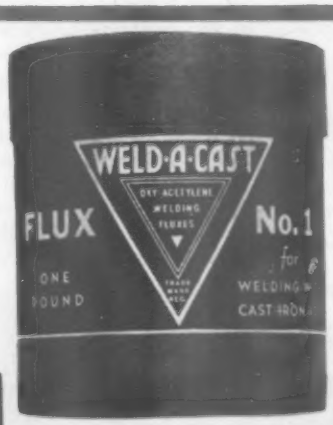
PNEUMATIC AND HAND CHISELS
"DALBO" AIR HOSE COUPLINGS
"DALLETT" PNEUMATIC SAFETY RETAINER SHANK CHISELS
"DALWELD" DETACHABLE WELDING CABLE CONNECTORS



WELD-A-CAST Flux

The old brand is still the best

No. 1. For Welding with Cast Iron Rod.

No. 3. For Brazing and Bronze Welding.

No. 4. For Welding Cast Aluminum.

Ask Your Dealer—or write

WELD-A-CAST
OXY-ACETYLENE WELDING FLUXES

CORTLAND WELDING COMPOUND CO.
Cortland, N. Y.

R. F. McClutt, for the past 15 years associated with the Chicago district sales office of Air Reduction Sales Co., has joined the Wayne Welding Supply Co., Inc., Fort Wayne, Ind., as general manager.

» «

L. M. Benkert, plant manager of Progressive Welder Co., has taken on the additional supervision of service and service engineering. **T. E. Kirchner,** formerly applications engineer with E. J. Budd Mfg. Co., and **J. A. Gable,** electrical engineer, have been assigned to the Progressive Welder field sales engineering staff.

Henry G. Goehring, former assistant director of industrial relations at The White Motor Co., Cleveland, has been advanced to the post of director of industrial relations. He succeeds **Lon A. Fleener,** who returns to his former position as manager of the wholesale division.

» «

Donald L. McGee, formerly advertising manager of Nutrition Research Laboratories, Chicago, has been appointed director of advertising for the Corronizing Div. of Standard Steel Spring Co., Coraopolis, Pa. He will direct the advertising and sales promotion program for Corronizing, a newly patented process for coating metals against rust.

» «

M. A. Cornish, formerly superintendent of the American Welding Co., a wholly-owned subsidiary of American Car and Foundry Co., has been placed in full charge of the latter concern's Carbondale, Pa., plant and office.

» «

J. K. Thompson has been promoted to the position of assistant manager of the Gary, Ind., plant of the American Bridge Co., U. S. Steel Corp. subsidiary. Mr. Thompson has been with this company for 43 years, his last position being assistant to the manager of the Gary plant.

» «

Chester L. Shaw has been appointed personnel director of the Warren City Mfg. Co., subsidiary of Graham-Paige Motors. He was formerly divisional manager of industrial relations at Willys-Overland.

» «

Harry D. Beutlich, formerly director of industrial relations for Willys-Overland Motors, Inc., Toledo, will serve in the same position with the Warren City Manufacturing Co., Warren, O.

» «

Henry Thomas Platz has been appointed district manager of Sciaky Brothers for eastern and northern Indiana and the entire state of Ohio. His offices will be in Cleveland. Mr. Platz was for the past 20 years associated with the Briggs Mfg. Co., where he was chief engineer of the tool, fixture and welding division and later executive engineer of the aircraft turret division. He resigned from the latter post to work as a consulting engineer on special projects.

» «

James McClure has been appointed public relations representative for the Pacific Coast for the Allis-Chalmers Mfg. Co. He will make his headquarters in the Allis-Chalmers San Francisco office. Until recently Mr. McClure served the Sacramento Air Service Command as training coördinator and director of employe welfare. Prior to that he was engaged in public relations work for the Pacific Gas and Electric Co.

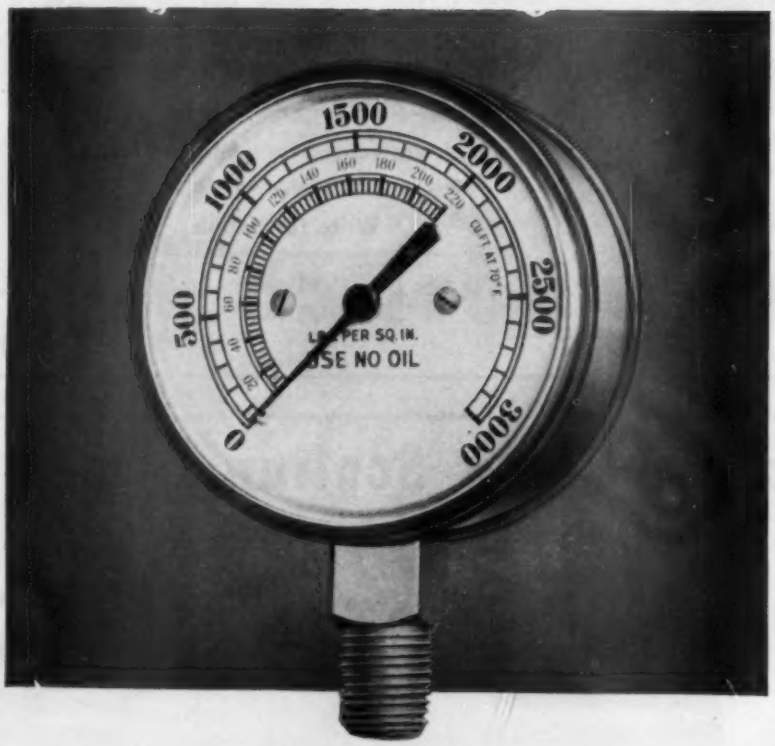
» «

Forest W. King, formerly master mechanic at Willys-Overland, has been appointed to the same position with **Warren City Mfg. Co.,** subsidiary of Graham-Paige. At the Warren, O., plant he will be in charge of the tooling division and all phases of engineering.

» «

Peter J. Coughlin has been named purchasing agent at the United Electronics Co., Newark. He was formerly with Titeflex.

AUTO-LITE Pressure Gauges



Operators who cut, treat or join metals by oxy-acetylene flame processes have the assurance and protection of proper pressures when their equipment includes Auto-Lite Pressure Gauges.

These gauges save man hours, serve to hasten essential production and conserve vital gases through precise pressure indication. Designed and manufactured by pioneers in the development of dial-type precision instruments, Auto-Lite Pressure Gauges are standard equipment for oxy-acetylene apparatus, and are listed as approved by Underwriters Laboratories.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
CHRYSLER BUILDING, NEW YORK 17, N. Y.
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Outstanding

● At a time when welders need superior equipment, CESCO announces a new, improved line of welding helmets.

These newly designed helmets are sturdier and simpler and have many fool-proof features.

Safety engineers give them unqualified approval. Welders who have tested them say they can't be beat for comfort. (That's an "earmark" of all CESCO head and eye safety equipment.)

AVAILABLE NOW!

Increased production permits offering these helmets immediately. Write today for your copy of CESCO'S NEW Welding Catalog . . . just off the press.

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FOR SAFETY

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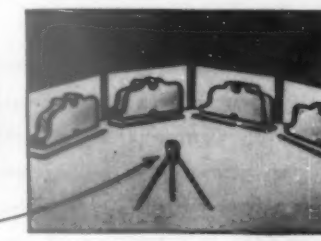
1 – BREAK IT DOWN . . . OR 2 – RADIOGRAPH IT!

(CANADIAN RADIUM HAS BEEN KNOWN TO PAY FOR ITSELF ON A SINGLE JOB!)

The "break-down" method consumes time, labor and vitally needed material—a practice that appears primitive compared with modern radiography. A radium capsule (you can rent or buy) and a supply of films are all you need to locate and clearly identify all types of internal flaws in castings and welds. Radium is compact, portable—requires no power, no attachments, no repairs, no "servicing." Readily available in units suited to the needs of your plant.



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..."Clear vision is vitally important. It is important for hour after hour, day in and day out. We've found that Thermacote lenses give that kind of vision—not for just a matter of hours but for days at a time. That is why we have been specifying these lenses since we first tested them."

Mr. Manning is President of the Manning Welding and Engineering Company of Newark, New Jersey. He is well-known for the accomplishments of his company in production of war materials and his activity on the membership committee of the American Welding Society.

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612 No. Michigan Ave. 11, Chicago, Ill.
1101 McLaughlin Blvd. Portland 2, Ore.
420 South San Pedro Street
Los Angeles 13, California

Hugo W. Liebert has been appointed general works manager of the Allis-Chalmers tractor plants, **Fred S. Mackey,** general works manager of the general machinery plants and **Harry E. Ladwig,** works manager of the West Allis foundries and pattern shops. Mr. Liebert was formerly works manager of the tractor plants, Mr. Mackey works manager of the supercharger plants, and Mr. Ladwig assistant general superintendent of the foundries and pattern shop.

» «

Herbert B. Lewis has become manager of the machinery division of the Lukens Steel Co. and its associates, By-Products Steel Corp. and Lukenweld, Inc. He was employed for 25 years by Brown & Sharpe Mfg. Co., by whom he had been granted leave of absence to conduct an extensive program of investigation, research and development for the improvement of the brakes used on military aircraft.

» «

A. A. Kucher, director of research of Bendix Aviation Corp. and chairman of its long-range planning committee, has been elected a vice-president.

» «

William S. Wilbraham, George L. Snyder and **Paul Sikora** have been advanced to new positions with Lukenweld, Inc., division of Lukens Steel Co. Mr. Wilbraham, formerly assistant to the general manager, has been made production manager. Mr. Snyder, formerly chief engineer, has been made chief engineer and assistant to the general manager. Mr. Sikora becomes plant accountant.

» «

J. H. Jewell, formerly assistant manager, has been appointed manager of the industry departments of the Westinghouse Electric and Mfg. Co.

» «

Mrs. Katherine Schmitt, top-sealing operator at United Electronics Co., Newark, has been awarded a commendation for production ideas by the board for individual awards of the War Production Board. Her suggestion enabled the company to speed up the production of a transmitting tube vital to the armed forces.

» «

William J. Van Vleck, formerly assistant manager of the Philadelphia district office of the Worthington Pump and Machinery Corp., has been appointed manager of the Atlanta office, succeeding **Edward Stauverman,** resigned.

» «

C. W. Camp, for 38 years with Crocker-Wheeler Electric Mfg. Co., has become consulting electrical engineer of the Worthington Pump and Machinery Corp., Harrison, N. J. He replaces the late **Harry Wood.**

It's a Cinch to Splice Welding Cable

with
PUNCH-LOK
Streamlined
BANDING METHOD

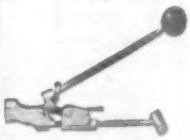
No Soldering • No Rigid Connections • with Punch-Lok

(1) Cut ends square, strip and place sections together. (2) Tension Punch-Lok band around the joint with Loking Tool. (3) Pein corners of lock smooth. (4) Insulate joint with tape or other means. Quickly and easily applied and no normal pull strain can tear it loose.

Punch-Lok is versatile. It connects hose, stops leaks in air, steam or water lines, reinforces and mends splits in cross-arms, ladder rails, poles, etc. Ties rigid conduit or flexible cable to pipe lines or girders, ties ends of wire or manila rope to prevent fraying—wherever a tight band can be used to connect, mend, splice or reinforce. It's easy, fast, economical, safe!

CLAMPS . . . Made of flat, high tensile galvanized steel or Everdur, which is a corrosion resistant copper base alloy. All clamps are double wrapped. Available from ¾" to 48" I.D. Any large size clamp can be pulled down to fit any smaller diameter.

LOKING TOOL . . . Sturdily constructed to assure long life. Locks all size clamps with a sufficient tensional pull.



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ELECTRODE HOLDER

..gives you a practical, sensible design for speedier operation.

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LESS FATIGUE. Light in weight (15 oz.), well balanced, streamlined and easy to handle. Makes work less tiresome.

NO ROD WASTE. Takes rods from smallest to ¼-in., inclusive. Release lever provides quick and easy rod change-over.

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All parts replaceable. 300 amps., 8½-in. in length. Reasonably priced.

DEALERS — Several attractive territories still open for rated distributors. Write factory for franchise details.

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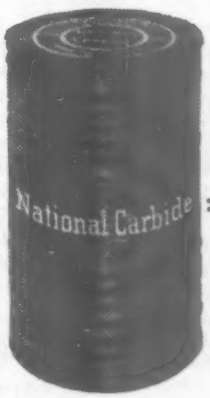

For Welding and Cutting
Specify

NATIONAL CARBIDE IN THE RED DRUM

•

NATIONAL CARBIDE CORPORATION
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SPECIFY

Speer Holdark Welding Electrodes

THE excellent current carrying capacity of Speer Holdark Welding Electrodes provides a steady penetrating arc of high heat value. This means more welds per electrode, greater savings in costs as the life of the electrodes is also increased.

Check Chart of Carrying Capacities

	CARBON RODS	HOLDARK ELECTRODES	SPECIAL GRAPHITE ELECTRODES
DIAMETER IN INCHES	WELDING CURRENT IN AMPERES		
3/16	30	30- 60	—
1/4	40	50-100	200
5/16	50	75-120	100- 300
3/8	60	100-160	200- 400
7/16	75	130-200	300- 500
1/2	85	175-250	300- 600
5/8	110	225-350	400- 700
3/4	130	300-450	600- 800
7/8	160	350-600	700-1000
1	200	400-750	800-1200

Holdark Electrodes are made of an improved material which has very good tensile strength and is strong enough to withstand the abuse of automatic welders. Speer Holdark Welding Electrodes are designed for either spot, butt or flash welding, and are readily adapted for small precision work as well as for large structural fabrication.

SCC
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"GENERAL" WELDING FUME EXHAUSTERS

For effective elimination of the *Noxious Fumes* from

Arc Welding

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Spray Painting, Etc.

TWO TO TEN INLETS—

For multiple hose connections in shop and field operations.

SINGLE INLET UNITS—

For exhaust from booth collector ducts; and in the smaller units.

High Velocity Exhaustion by High Speed Centrifugal Fans for Small, Easily Handled Hoses

---

SEMI-PORTABLES—

Movable by crane hook or carrying bar; or for fixed (duct) service. ¾ to 15 motor horsepower.

PORTABLE "JUNIORS"—

40 to 100 pounds in weight; one or two inlet nozzles.

Self-closing caps on all nozzles.
Rugged, all-steel construction.
Motored for continuous service.
Controls protected within base.

Bulletin CB-103 gives specifications and dimensions for the 88 types and sizes comprising the "General" line.

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Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Stainless-Steel Booklet

How to escape the more common pitfalls which all too often render the welding of stainless steels a difficult and chancy business is told in "Things to Know about Welding Stainless Steels," a 28-page, 4 by 9 in. booklet published by **The McKay Co.**, York, Pa. This book originated in a "true or false" quiz conducted among the members of the McKay organization. The discussions evoked proved to be so interesting that it was felt they should be made available to outsiders in booklet form.

The first section of the booklet gives the results of the quiz: 19 "true or false" statements, each of which is followed by the correct answer and a full explanation. The reader can thus test his own knowledge before proceeding to the remaining material.

Three tables cover respectively the specific effects of alloys in steel, the A-B-C of corrosion and heat-resisting steels (martensitic, ferritic and austenitic), and a stainless electrode analysis and color chart. These are followed by several pages discussing the metallurgical structures and physical characteristics of the three groups of stainless steels: martensitic (straight chromium steels under 16% Cr), ferritic (straight chromium steels over 18% Cr) and austenitic (18% Cr—8% Ni and steels of higher alloy content containing both chromium and nickel with or without additional alloying elements). Two pages of information on new developments in stainless electrodes bring the work to a close.

The text is for the most part written in non-technical language and frankly slanted at the shop man and not the metallurgist. Its aim is to give the weldor and the shop foreman a practical working knowledge of stainless steels—a knowledge that they have hitherto found difficult to obtain. All in all, this publication is a highly worth-while contribution to welding literature.

» «

Arc-Welding Manual

The condensed manual "Working Principles of Electric Arc Welding" (72 pages, 5½ by 8½ in.) comprises a useful summary of information on arc-welding fundamentals. The entire content is treated with a minimum of technical language; this feature plus the many illustrations, exercises and instructions on various types of welds should make the book a suitable manual for shop trainees. However, much practical information for design engineers is also provided.

The table of contents includes such subjects as: arc phenomena, welding equipment, welding electrodes and weld-metal quality, engineering and design, forms of welded joints, functions of the welding shop, instructions to beginners, the weldability of ferrous metals, arc cutting and back gouging, steel testing by the spark method, metallurgical facts about iron and steel, welding symbols and their application. In addition, there are eleven exercises, each illustrated with appropriate sketches, which range from the deposit of simple beads to overhead welds, circular welds and welds in heavy plates.

Copies of this manual, Bulletin W-53, may be obtained at $1 each from the welding division of **Harnischfeger Corp.**, 4400 West National Ave., Milwaukee 14.

» «

Tool-Steel Electrode Catalog

A 28-page, letterhead-size catalog, "Alloy Arc-Welding Electrodes," has been published to describe the new "Arcaloy" tool-steel welding electrodes for six different applications: high-speed steel, air-hardening steel, water-hardening steel, oil-hardening steel, hot-working steel and work-hardening steel. Photomicrographs, tempering charts and illustrations of typical welds are included. General instructions are given for preparation, preheating, welding and tempering, and there are also a hardness conversion table, a summary of hardening and tempering colors, and a two-page tabulation on the classification of tool steels according to their percentages of carbon, silicon, manganese, tungsten, cobalt, vanadium, chromium, nickel and molybdenum. **Alloy Rods Co.**, York, Pa.

» «

Hard-Facing Pamphlet

"Cut Costs with Haynes Stellite Hard-Facing Rods" is the title of a 3¼ by 6 in. pamphlet which explains the advantages of protecting wearing parts by hard-facing and lists typical parts that can be hard-faced in various industries: agriculture, brick and cement, iron and steel, mining and excavating, lumber and paper, manufacturing. It is available in either single copies for individuals or in quantities for distribution by welding shops to their customers. **Haynes Stellite Co.**, Kokomo, Ind.

Move the Grinding Wheel Rather Than the Casting . . .

Use a

STOW FLEXIBLE-SHAFT Mobile Power Unit

Stow Flexible Shaft connected to belt-driven pulley for heavy-duty grinding.

It's easier, faster, cheaper —and safer by far—to move the tool instead of the work. Especially when you're grinding, sanding, drilling, filing or buffing heavy and unwieldly parts; That's why Stow Flexible-Shaft Mobile Power Units have paid their way many times over—in fabricating shops, assembly lines, foundries, welderies, tool and machine shops.

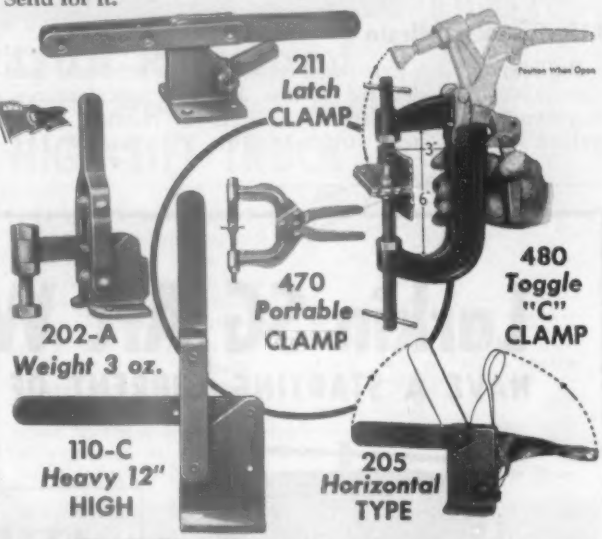
Stow Flexible Shafting—the original flexible shafting—is the heart of every Stow machine. It's made sturdy enough to take on the heaviest jobs, and supple enough for the most delicate work . . . a range of service that embodies nearly 70 years of specialized experience in shaft manufacture. For information on standard models for many uses, ask for Catalog 40B.

Build your own portable tool. *Just attach a Stow Flexible Shaft to any idle motor or to a power take-off. We'll tell you how. Write today for complete facts, or call your Stow Distributor.*

STOW Manufacturing Co.
7 Sheer St., Binghamton, N. Y.

Building JIGS or FIXTURES?

Then you'll need some of those quick acting, positive holding, De-Sta-Co Toggle Clamps . . . Bulletin No. 43 will help you select the clamps best suited to your job. Send for it.



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372 Midland Ave • Detroit 3, Mich.

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WELD FASTER, EASIER, AT LOWER COST!

Model WP-2—2500 lbs. Capacity

There are more big time-and-money-saving advantages in this new P&H WP-2 Welding Positioner than you would believe possible — at such surprisingly low cost.

The WP-2 is the most versatile positioner in its class — easiest to operate. Of all-welded steel construction with large table area and hydraulic power tilting — it is available with manual, handwheel or power turning. Has positive table locking device — telescopic elevation.

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. . . of facts and pictures giving complete story! Start now to save time, costs by positioning your work. It shows you how! Ask for Bulletin P2-1.

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ARC WELDERS • EXCAVATORS • ELECTRIC CRANES P&H MOTORS • HOISTS • WELDING ELECTRODES

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Can be Salvaged by using COLMONOY

TIPPING SERVICE

● New tip castings of Colmonoy No. 6 can now be applied to your centers by using Silver Solder or a low temperature brazing alloy. Will outlast and outwear new, untipped centers.

We will apply for you, or furnish tips only. Moderate prices. Write for Bulletin CT-1 for complete information.

WALL-COLMONOY CORP.
720 Fisher Bldg., Detroit 2, Mich.

Tweco Catalog

The new two-color, 12-page, letterhead-size "Twecolog" illustrates and describes the Tweco lines of "Hol-Grip" and other types of electrode holders, cable connectors, ground clamps, jig and fixture clamps, hooks and wedges, etc. **Tweco Products Co.**, English at Ida, Wichita 7, Kansas.

» «

Lift-Truck Bulletin

Bulletin 136 is a four-page, letterhead-size publication devoted to the Lyon-Raymond "high-lift" truck. This is a welded tubular steel structure with a lifting capacity of 1,000 lb, which can be elevated hydraulically to a height anywhere between 6 and 48 in. **Lyon-Raymond Corp.**, 1732 Madison St., Greene, N. Y.

» «

Positioner Bulletin

A new two-color four-page, letterhead-size bulletin, No. 2550, presents in concise form the full line of Ransome welding and assembly positioning equipment. Photographic reproductions, specifications, load-rating tables and important features of the positioners are included. **Ransome Machinery Co.**, Dunellen, N. J.

Resistance-Welding Standards

The first set of resistance-welding standards to be offered since the invention of this process in 1886 has just been published. This 72-page, letterhead-size book contains all of the standards that have thus far been developed and approved. These are: nomenclature and definitions; spot-welder standards, horn type; spot and projection welder standards, press type; seam-welder standards; upset-butt and flash-butt welder standards; stored-energy welder standards; electrical standards for resistance welding equipment; electrodes. Copies may be obtained without cost from the **Resistance Welder Manufacturers Association**, 505 Arch St., Philadelphia 6.

» «

Seam-Welder Controls

A 12-page, letterhead-size booklet, GEA-4220, is published by the **General Electric Co.**, Schenectady, to give general and specific information on electronic seam-welder controls. The equipment described is for rapid-change electronic timing; for chain-type timing; for higher-voltage or power-factor-corrected seam welders; for a combination of spot, seam and pulsation welding, etc.

» «

Marine-Piping Rules

"Rules for Fusion Welding Piping in Marine Construction" is a revision of an AWS standard first published in 1938. The original data for the welding of low-carbon steel (0.35% max.) marine piping are thus brought up to date. Among the topics included are: qualification of welding procedure, qualification of welding operators; design; layout and dimensions of piping; allowable types of joint; preheating; stress-relieving; radiographic tests; hydrostatic tests. The 6 by 9 in. bulletin can be obtained for 25c a copy from the **American Welding Society**, 33 West 39th St., New York City 18.

» «

"Metal Quality"

How hot working improves the quality of steel is told with picture and text in "Metal Quality," an elaborate 44-page, letterhead-size booklet issued by the technical committee of the **Drop Forging Association**, 605 Hanna Bldg., Cleveland. Seven stages in the fabrication of forged steel articles are discussed: molten steel, ingots of cast steel, rolling blooms and billets, bars rolled from billets, impression-forging dies, drop-forging hammer method of producing forgings to specified shapes, hot working to improve forging quality.

» «

Electrode Catalog

"Eureka Tool-Steel Welding Electrodes" is the title of a 44-page, letterhead-size catalog recently published by **Welding Equipment and Supply Co.**, 223 Leib St., Detroit 7.

Larkin SG Arc Welders

HAVE A STARTING CURRENT OF 5 AMPERES

Model No. 300G (25-300 amperes) Most popular size these days

ATTENTION:
Industries welding thin metal.

Arc welding thin sheet metal is now EASY. Available 150, 250 and 300 amp. models. Continuous adjustment from 5 amperes to top rating.

ARC and SPOT WELDERS FOR every welding need.

LARKIN LECTRO PRODUCTS CO., MANUFACTURERS

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Is creating faster production wherever it is used
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1. Fear of overheating cast iron can be forgotten.
2. Cleaning and grinding are unnecessary with "York's 77".
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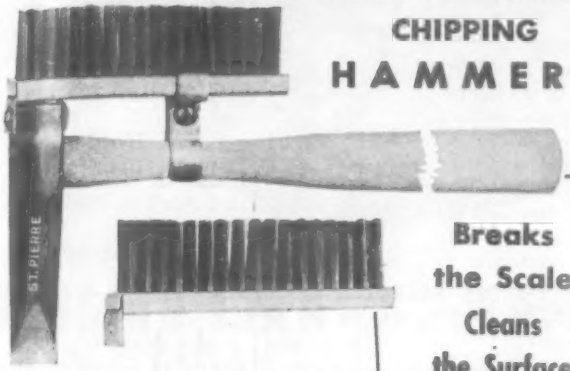
ABUSE MEANS NOTHING TO ST. PIERRE

CHIPPING HAMMERS



Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

Breaks the Scale Cleans the Surface in One Operation

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The NEW, IMPROVED Variable-Core type

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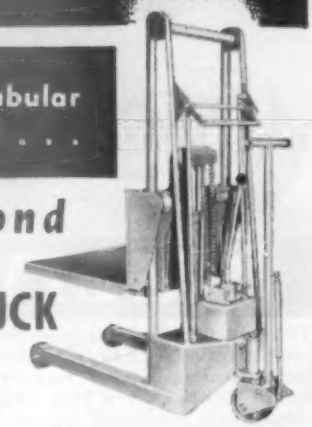
New Combined Transporting and Tiering Truck . . .

Construction: Tubular and Formed Steel . . .



LYON-Raymond *Hydraulic* HIGH-LIFT TRUCK

Unusual lightness, sturdiness, maneuverability and elevating range make this new combination truck as efficient for easy transportation of heavy loads around the plant as for quick, safe tiering in crowded storage alleys. Its in-built versatility makes the LYON-Raymond High-Lift TRUCK the answer to many other material handling problems—all explained in Bulletin 136. *Write for it today!*

Standard Stock Model: Capacity, 1,000 lbs.—Platform size, 24"x30"—Elevating range, from 6" to 48"—Timken equipped—Welded fabrication.

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386 Madison St., Greene, N. Y.

The RIGHT FLUX for the JOB

No. 2 FLUXINE for brazing and bronze welding—copper, copper alloys, malleable iron and steel.

No. 6 FLUXINE . . . non-glaring . . . for bronze bonding—cast and gray iron with bronze and nickel alloy rods.

No. 7 FLUXINE for welding all types of aluminum.

No. 18 FLUXINE for gas and atomic hydrogen welding of stainless steels and inconel.

No. 41 FLUXINE used with high-melting silver solders on copper and its alloys and on steel.

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SAFETY

You will get the maximum in worker eye protection with Willson Safety Spectacles. Reasons . . . heat treated, SUPER-TOUGH lenses; every lens individually tested; new reinforced frames. With or without sideshields.

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Handsome modern appearance will appeal to workers. They are regular glasses that protect the eyes without attracting attention. Available in flat lens, 1.25 curve, or 6 curve.

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Workers get custom-fit comfort with nine variations of lens and bridge size. Safety becomes second nature because these spectacles fit, feel good and workers keep them on.

Get in touch with your Willson Safety Service Distributor for full information. Or, write to Dept. WE-2.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

READING, PA., U. S. A. Established 1870

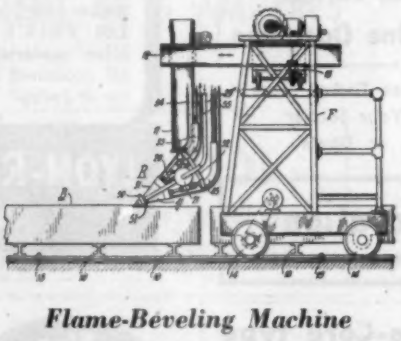
FROM THE PATENT OFFICE

Finned Tube

2,355,621. **John W. Brown, Jr.**, Lakewood, O., assigned to **Brown Fintube Co.**, Elyria, O. Filed April 2, 1941. Issued Aug. 15, 1944.

A method of making finned tubes by resistance welding the base of a channel section to the tube. The channel section also has two flanges extending to the exterior of the tube; the flanges are bent toward each other to bring into contact their outer edges, which are then welded together to form a closed hollow fin. The base portion substantially conforms to the outer surface of the tube, to which it is joined by autogenously welded areas.

» «



Flame-Beveling Machine

2,356,197. **Homer W. Jones**, Westfield, and **Wilgot J. Jacobson**, Plainfield, N. J., assigned to **The Linde Air Products Co.** Filed Dec. 19, 1941. Issued Aug. 22, 1944.

A flame-cutting machine for scarfing ferrous metal, comprising a row of nozzle units to produce a ribbonlike flame of high temperature and a corresponding row of oxidizing-gas nozzle units adapted to discharge a flat stream of oxygen adjacent to the flame. All of these units are connected in assembled relation so that the individual units of each row are in end-to-end alignment and the rows are in parallel relation with each other. The units are supported in such position that the oxygen stream is obliquely impinged upon the surface to be removed. A means for moving the torch device relative to the body to be operated upon is also included.

» «

Torch Tip

2,355,849. **John C. Crowley**, Cleveland Heights, O., assigned to **The Dill Mfg. Co.**, Cleveland. Filed June 16, 1939. Issued Aug. 15, 1944.

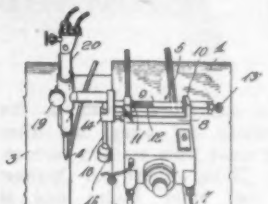
A cutting-torch head having an oxygen passage provided with a threaded bore having a conical inner end. There are three counterbores and an annular projecting rib, which is located at the inner end of the second counterbore. An inner tip member of polygonal concave configuration has a number of longitudinally extending sharp-corner edges with intermediate grooves of relatively large area. The grooves between the edges of the inner tip and the interior of the shell constitute passages of relatively large capacity, while the grooves in the tapered portion of the inner tip together with the inner surface of the shell constitute passages of relatively small capacity. The clearance between the tip member and the first and second counterbores and the rib constitutes an annular passage connecting the passages of large capacity with the combustible mixture passage.

» «

Cutting-Torch Holder

2,356,811. **Norman G. Bellrose**, Long Beach, Calif. Filed April 8, 1943. Issued Aug. 29, 1944.

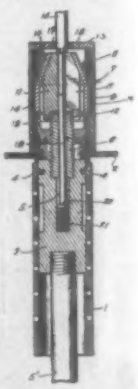
A tool holder with a U-shaped frame



on which is mounted a slidable hollow bar. On one end of the bar is a head having a vertical clamp adapted to grip a tool and support it vertically. A guide roller is mounted on a stem, extending upwardly therefrom, and is adjustably mounted in the head. The hollow bar has opposed longitudinal slots through which is inserted a pin rising from the frame. The bar also contains a coil spring, one end of which bears against the pin. At its other end the spring bears against an adjusting screw in one end of the bar.

» «

Electrode Holder



2,357,844. **Le Roy J. Nellis**, New Orleans, La. Filed March 18, 1943. Issued Sept. 12, 1944.

An electrode holder having a tubular handle of insulation material, a metallic core fixed in one end of the handle, a reduced tubular shank threaded into the core and an ejector rod slidably mounted in the shank. The rod is spring-loaded at its other end within the core. A chuck including a housing is threaded onto the shank forwardly of the handle for turning forwardly and rearwardly on the shank. A disc slidably mounted on the front-end portion of the ejector rod seats against the outer end of the shank, and jaws are pivotally mounted on the disc. The jaws close by turning of the housing rearwardly, which action causes the disc to seat against the outer end of the shank.

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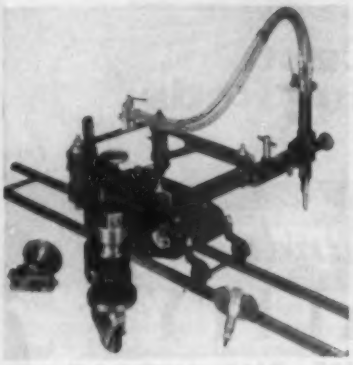

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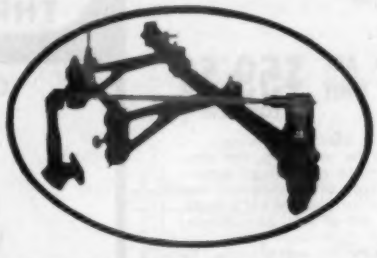

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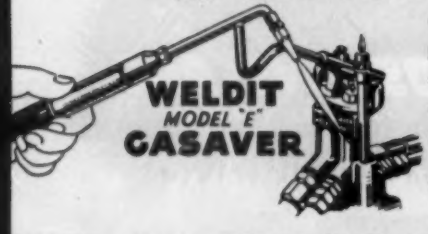

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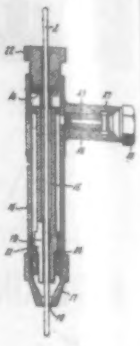
Electrode Holder



2,358,158. **Christian P. Gibbert,** Sellersville, Pa., assigned to **General Electric Co.,** Schenectady, N. Y. Filed April 17, 1943. Issued Sept. 12, 1944.

An electrode holder having a support in which a clamping member is mounted for tilting movement. Through the latter runs an electrode passageway, the opposite side walls of which are brought into clamping engagement with an electrode by the tilting movement of the clamping member. An element projecting from the support has an end surface angularly disposed to and abutting the end surface of the clamping member in order to tilt the latter and so bring it into clamping engagement with the electrode.

» «

Alloy-Steel Electrode

2,356,822. **John J. Chyle,** Wauwatosa, Wisc., assigned to **A. O. Smith Corp.,** Milwaukee. Filed Sept. 24, 1942. Issued Aug. 29, 1944.

A welding electrode for welding low-alloy, high-tensile steel. It contains in excess of 0.30% carbon and alloying ingredients of chromium, nickel and molybdenum. The molybdenum content is substantially higher than that of the work being welded in order to provide a weld of tensile strength substantially equal to that of the stock.

» «

Weld-Treating Method

2,356,854. **Stanley B. Kirk,** New Rochelle, N. Y., assigned to **The Linde Air Products Co.** Filed July 29, 1943. Issued Aug. 29, 1944.

A method of treating pressure welds to reduce the cross-section. The welded region is maintained at an elevated temperature below the liquidus but not far below the solidus while a tensile force is applied to the welded members at right angles to the plane of the weld. This force elongates the metal at the weld region and reduces its cross-section.

» «

Seam Welder

2,356,643. **Harry A. Allshouse** and **Rex H. Dyer,** Kansas City, Mo., assigned to **Welder Patents Inc.,** Kansas City. Filed Dec. 15, 1941. Issued Aug. 22, 1944.

A seam-welding machine including a work support, clamping means for the work, a welding mechanism supported on a motor-driven carriage for movement across the work support and a percussion means also supported by the carriage. It is the purpose of the percussion mechanism to peen the zone affected by the welding heat. The means for energizing the motor includes a means for effecting actuation of the percussion apparatus.

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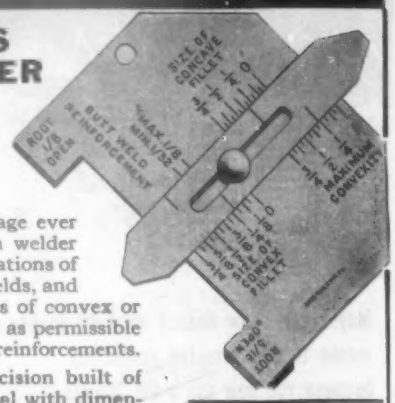

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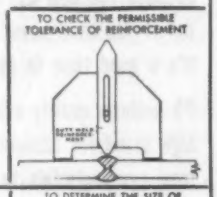

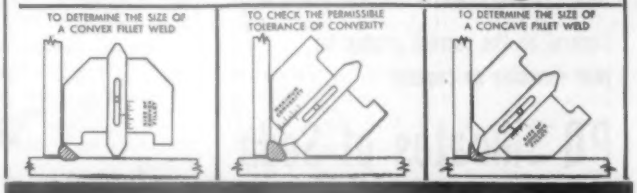
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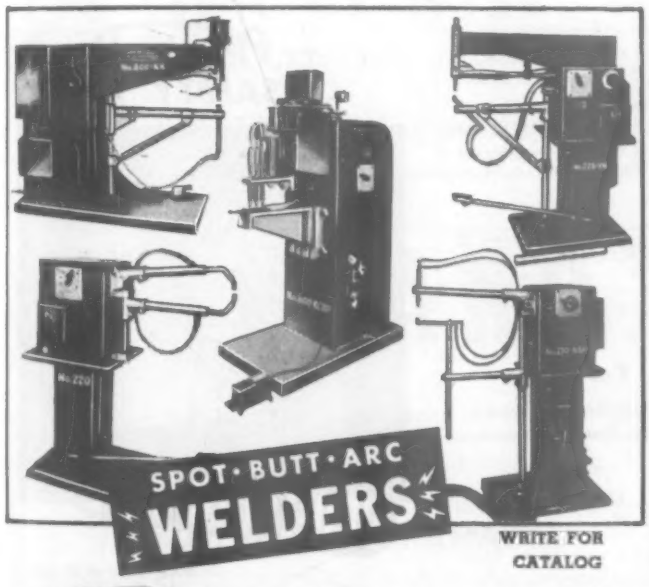

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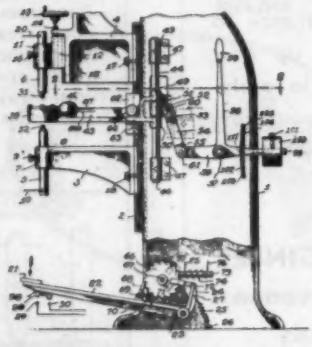
Resistance-Welding Circuit

2,356,765. **Hans Klemperer,** Belmont, Mass., assigned to **Raytheon Mfg. Co.,** Newton, Mass. Filed Oct. 23, 1942. Issued Aug. 29, 1944.

A resistance-welding circuit including a means for supplying a pulse of current having a substantial d-c component to the input of the transformer in such fashion that a corresponding pulse of current appears in the output circuit. When the current pulse in the output circuit has fallen to a relatively low value, current is supplied to the input in a direction opposite to that of the pulse first supplied. The decrease of current in the output circuit is thus rapidly accelerated.

» «



Automatic Electrode Dresser

2,357,038. **John C. Whitesell, Jr.,** Norristown, Pa., assigned to **Edward G. Budd Mfg. Co.,** Philadelphia. Filed June 13, 1941. Issued Aug. 29, 1944.

A rotatable truing tool for spot-welding electrodes. The tool support is mounted upon the supporting base of the welder, and the tool may be moved into and out of truing alignment with the electrode. Tool is driven by power means.

» «

Preheating Torch

2,356,048. **Guy F. Goddeau,** Chicago, assigned to **The Liquid Carbonic Corp.,** Chicago. Filed Jan. 5, 1942. Issued Aug. 15, 1944.

A heating torch having a burner nozzle through which the products of combustion are delivered at a relatively high velocity. The nozzle includes a cylindrical tube surrounding the outer end of the combustion-feeding chamber and forming a continuation of it. Gas escape ports in the outer end of the combustion-feeding tube communicate with an annular channel of the nozzle, located at the point where it surrounds the tube. A baffle plate pierced with openings surrounds the delivery end of the nozzle. A secondary nozzle, surrounding and spaced from the burner nozzle, has a bottom that receives the combustion-feeding tube; the end of the latter nozzle is open and extends beyond the tip of the burner nozzle.

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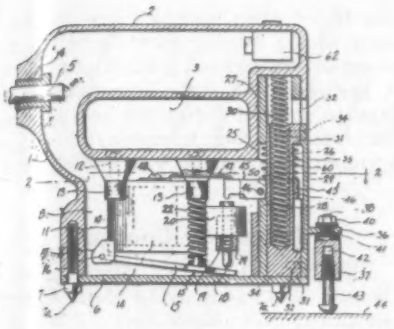


Stud Gun

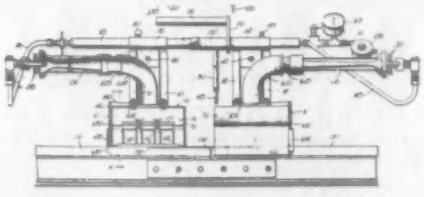
2,356,320. **Grover A. Hughes,** Seattle, assigned one-third to **Robert W. Hughes** and one-third to **Roger G. Hughes,** both of Seattle. Filed March 29, 1943. Issued Aug. 22, 1944.

A gun for the arc welding of studs to plates. Elements include a housing with plate-engaging support, a plunger slidable in the housing, a stud holder fixed to the plunger, pressure means acting against the plunger to drive a stud against the plate, a clutch associated with the plunger and a means in the housing operable against the clutch to lift the plunger. There are also an arc-initiating current circuit with a normally open switch, an a-c transformer, a supply circuit including the transformer primary winding, a welding circuit including the transformer secondary, normally open switches in the supply and welding circuits and a switch-timing means. The latter closes and opens the circuit for the arc-initiating current and also closes and opens the supply-circuit and welding-circuit switches.

» «

Rail Joint Preheater

2,356,393. **Royal E. Frickey,** San Francisco. Filed May 23, 1941. Issued Aug. 22, 1944.



A portable rail joint heater having a pair of aligned heating units mounted on a frame. The lower part of each unit has a means for positioning it on a rail ball. A laterally adjustable means connects each heating unit to the frame so that each unit may properly engage a rail at a rail joint regardless of different canting between the two rails. The distance between the heating units may be varied to permit the two units to be centered over two selected points in the rail ends without regard to the distances of the points from the tips of the rail ends.

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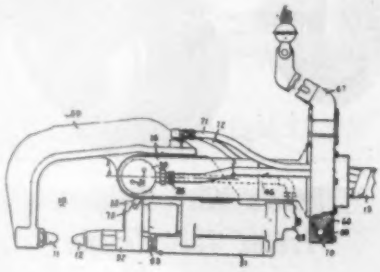

Welding Gun

2,358,155. **Oscar C. Frederick,** Springfield, Pa., assigned to **General Electric Co.** Filed July 26, 1940. Issued Sept. 12, 1944.

This patent covers a pair of welding electrodes mounted on a frame and a means including a pair of current-carrying conductors for completing an electric circuit to the electrodes. Frame is pivotally mounted with respect to the conductors. A fluid-pressure-operated device coöperates with the mounting to clamp frame and one conductor in order to prevent relative movement between them.

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Metal-Shielded Rod

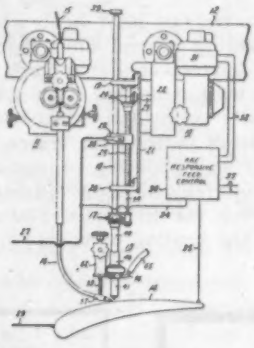
2,359,813. **Rene Wassermann,** New York City. Filed April 6, 1942. Issued Oct. 10, 1944.

A rod for welding, brazing and soldering operations. It has a core of weld material and a corrosion-resistant metallic film extending at least partially over the circumference and length of the core so as to protect its surface against the attack of atmospheric influences during the storage period. The thickness of the film is below 0.01 in., and it is therefore insufficient in quantity to affect the composition of the weld metal.

» «

Gas-Shielded Arc Welding

2,360,160. **Lionel G. Pickhaver,** Chicago, assigned to **General Electric Co.,** Schenectady, N. Y. Filed Dec. 29, 1943. Issued Oct. 10, 1944.



A gas-shielded arc-welding apparatus comprising: an electrode-holding means; a nozzle for supplying gas about the arcing terminal of an electrode; a means for adjusting electrode and nozzle in order to position the arcing terminal relatively to the nozzle discharge opening; a means for connecting the electrode in an arc-welding circuit; a means responsive to departures from a desired length and voltage of the arc for maintaining the position which will establish an arc of the predetermined length and voltage.

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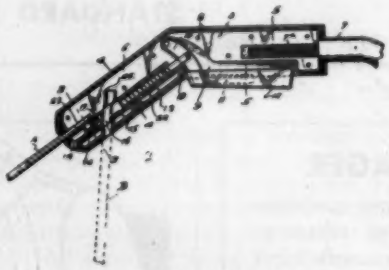

Electrode Holder

2,356,054. **James H. Hill,** Redondo Beach, Calif., assigned 49% to **Howard F. Craven,** Redondo Beach, Calif.

An electrode holder having an elongated handle and a rigid nose portion extending at an angle from the outer end of the handle. The nose portion has a main longitudinal bore, outer portion of which communicates with a second short bore. The short bore is adapted to receive the end of a welding electrode. Slidable in the main bore is a head having a stem with a sloping front; a ball is disposed on the inclined portion of the head. A spring in the main bore acts on the head to force it forwardly and so cause the sloping portion to move the ball into gripping engagement with the electrode.

» «

Electrode Coating

2,355,988. **David L. Mathias,** East Orange, N. J., assigned to **Metal & Thermit Corp.,** New York City. Filed Dec. 10, 1943. Issued Aug. 15, 1944.

A coating for an arc-welding electrode. Its composition is about 5 to 30% carbohydrate by weight and about 2 to 15% brucite.

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